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(12) **United States Patent**
Taylor et al.

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(45) **Date of Patent: Jul. 12, 2022**

(54) **VISE**

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(73) Assignee: **Jergens, Inc.**, Cleveland, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 246 days.

(21) Appl. No.: **16/561,876**

(22) Filed: **Sep. 5, 2019**

Related U.S. Application Data

(60) Provisional application No. 62/727,852, filed on Sep. 6, 2018.

(51) **Int. Cl.**
B25B 1/10 (2006.01)
B25B 1/24 (2006.01)

(52) **U.S. Cl.**
CPC ***B25B 1/103*** (2013.01); ***B25B 1/2473*** (2013.01); ***B25B 1/2478*** (2013.01); ***B25B 1/2484*** (2013.01); *B25B 1/2405* (2013.01)

(58) **Field of Classification Search**
CPC B25B 1/2405; B25B 1/103; B25B 1/2473; B25B 1/24; B25B 1/00; B25B 1/12; B25B 1/2478; B25B 1/2484; B25B 1/2489
USPC 269/136, 43, 154
See application file for complete search history.

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Primary Examiner — Mahdi H Nejad

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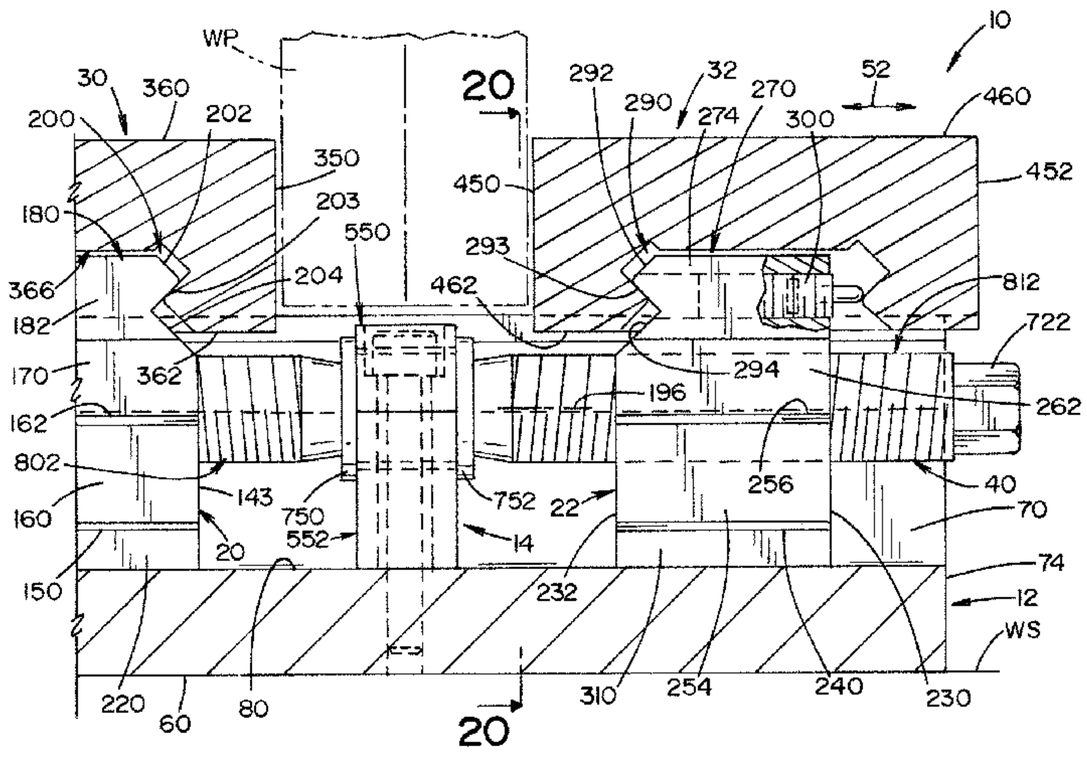
(57) **ABSTRACT**

A vise for holding a workpiece that reduces jaw lift having a vise base with a longitudinally extending guide channel that includes vise base flanges with base flange guide surfaces, the vise having vise trucks that move longitudinally within the guide channel, the vise having jaws that are selectively securable relative to the trucks wherein the jaws and the trucks include lift surfaces that move the trucks toward the jaws transversely to the longitudinal direction as the jaws engage the workpiece to lock the jaws and the trucks relative to the guide channel when the workpiece is clamped in the vise.

23 Claims, 13 Drawing Sheets



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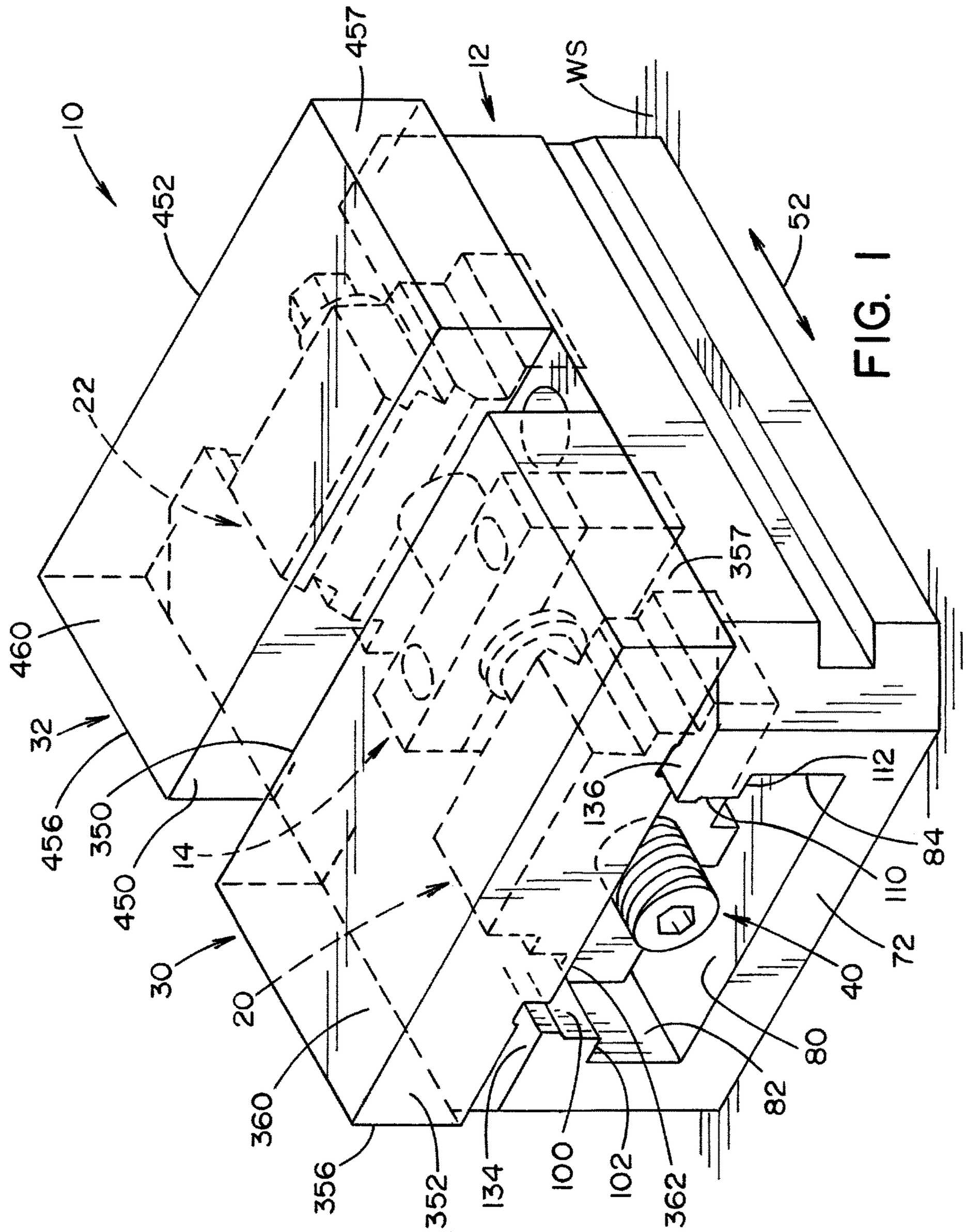
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FIG. 1

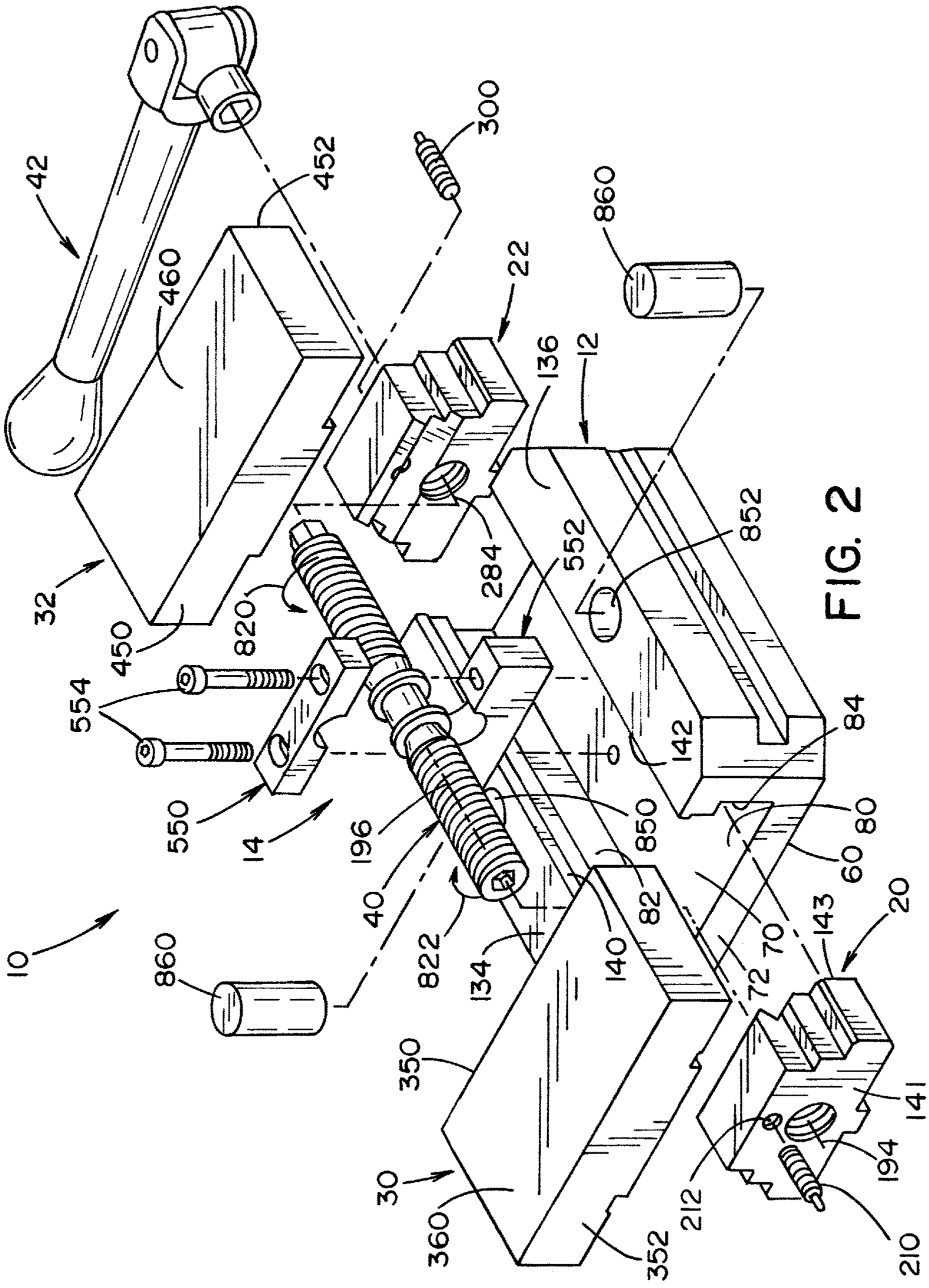
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FIG. 2

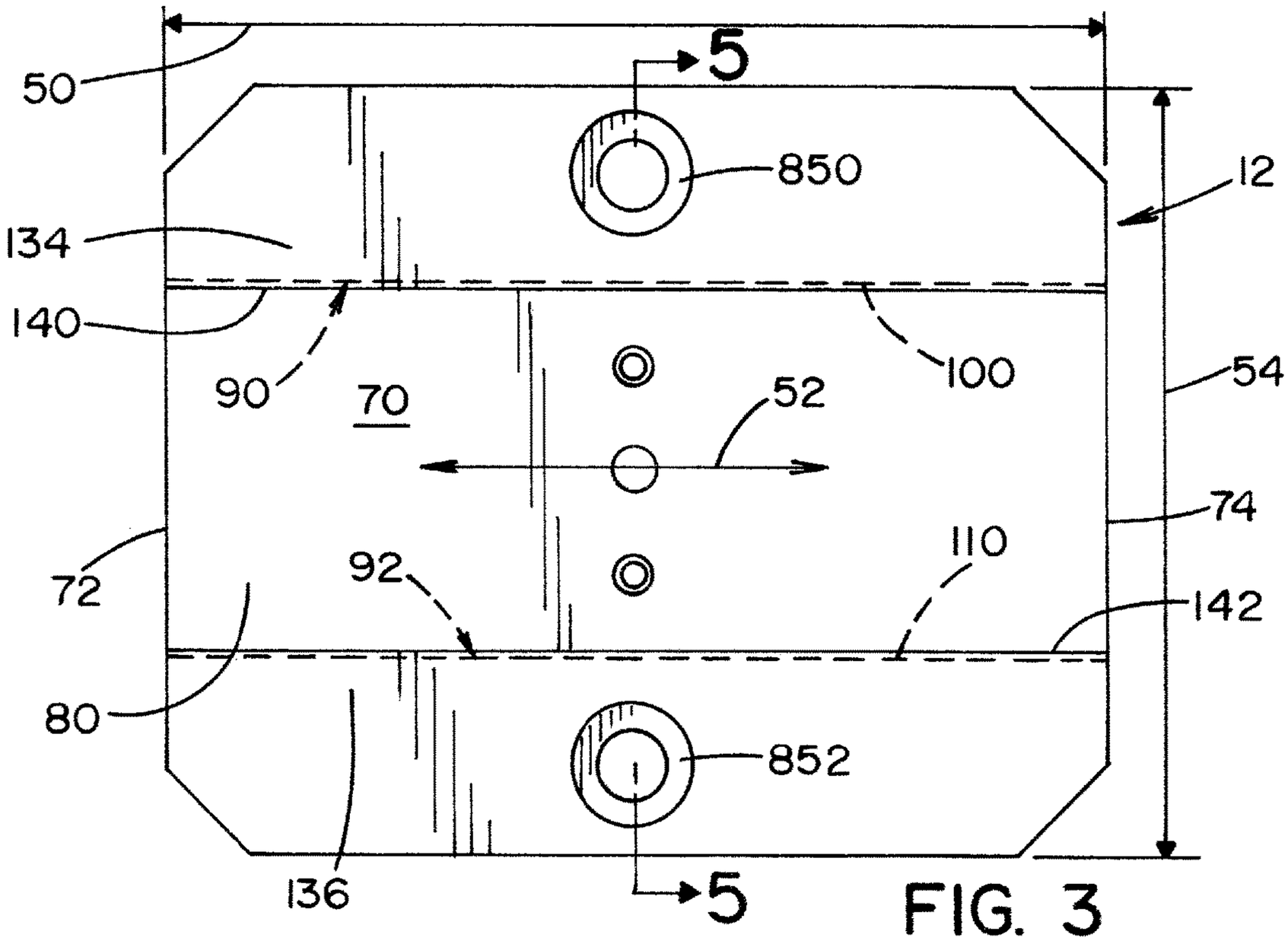
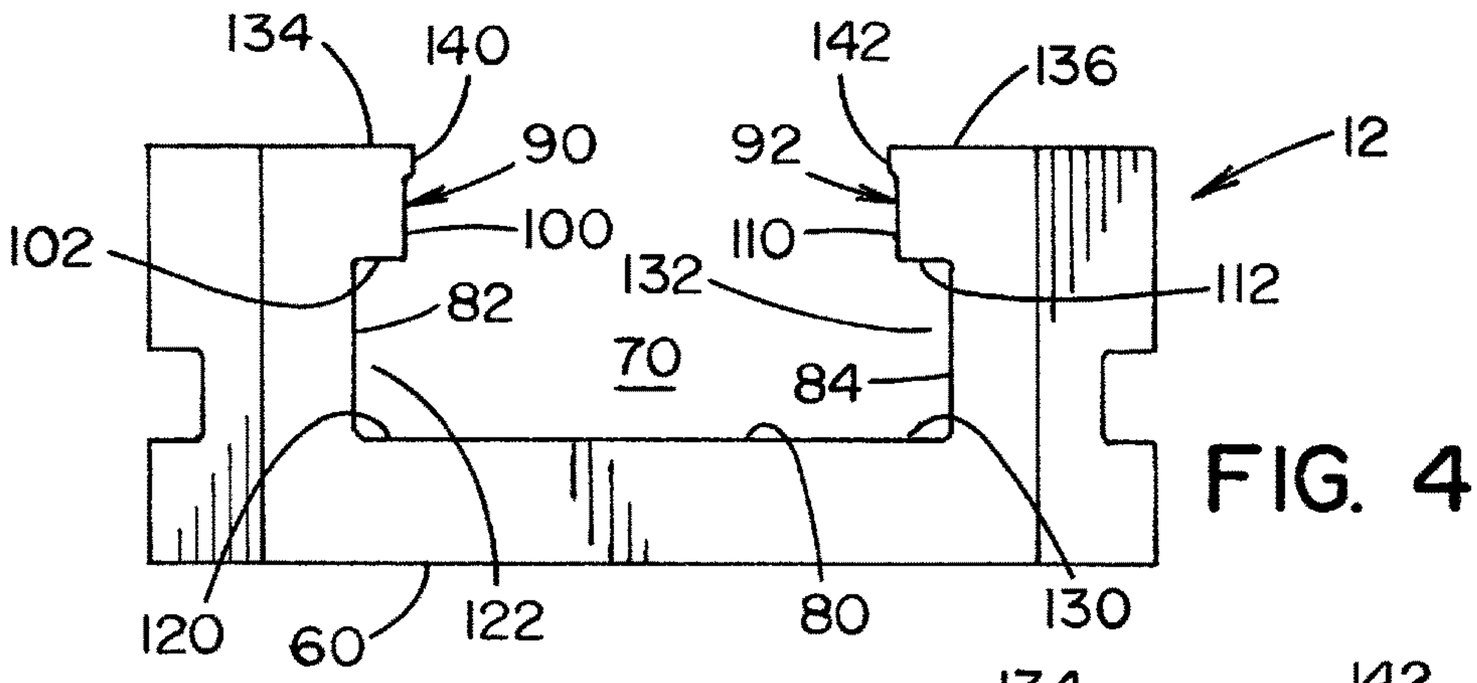


FIG. 3



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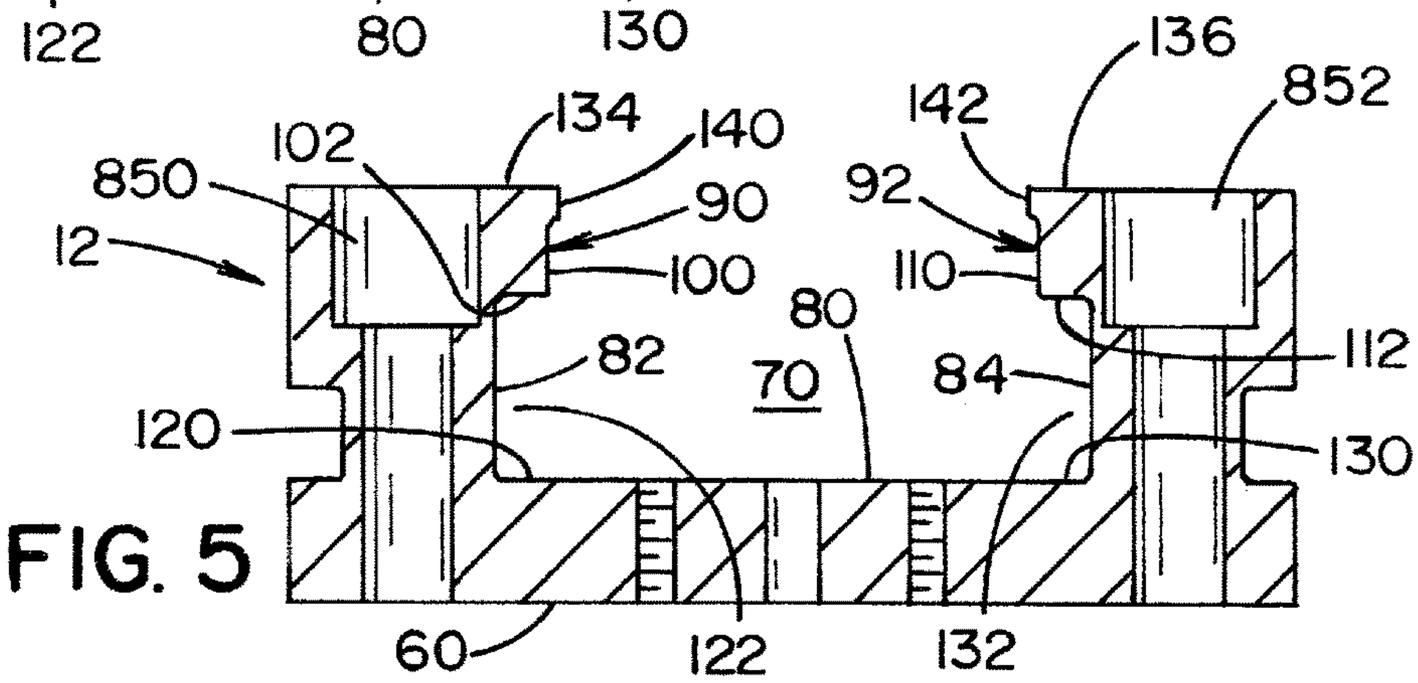

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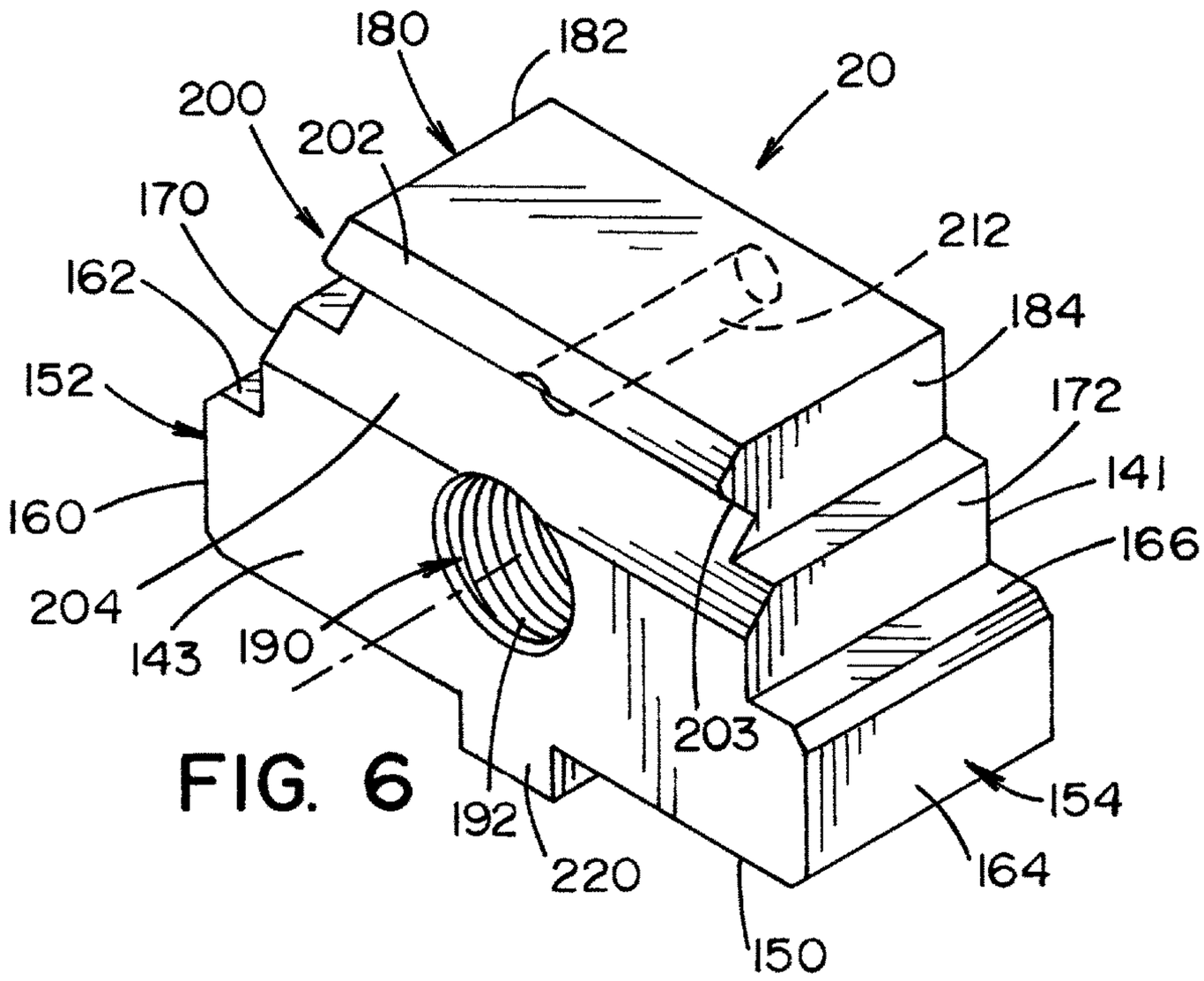

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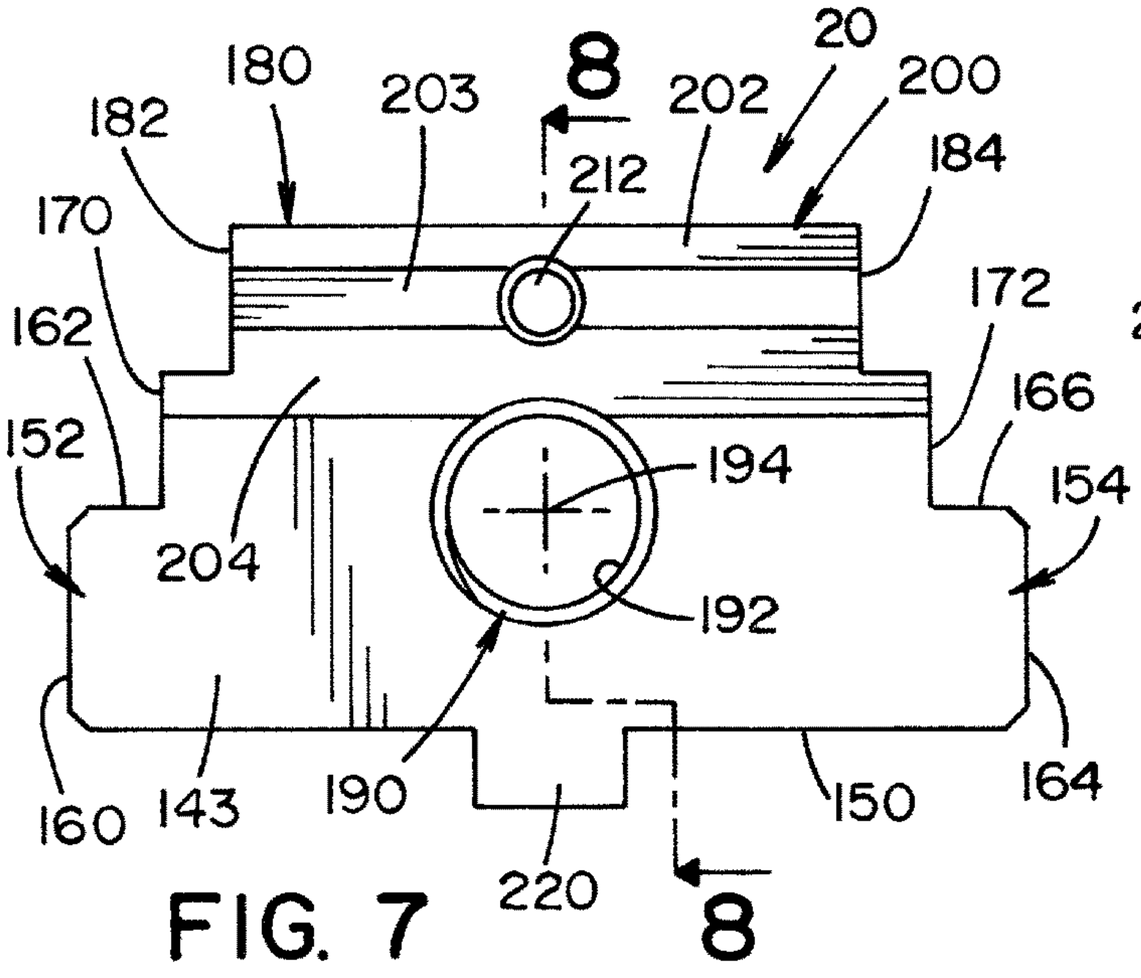

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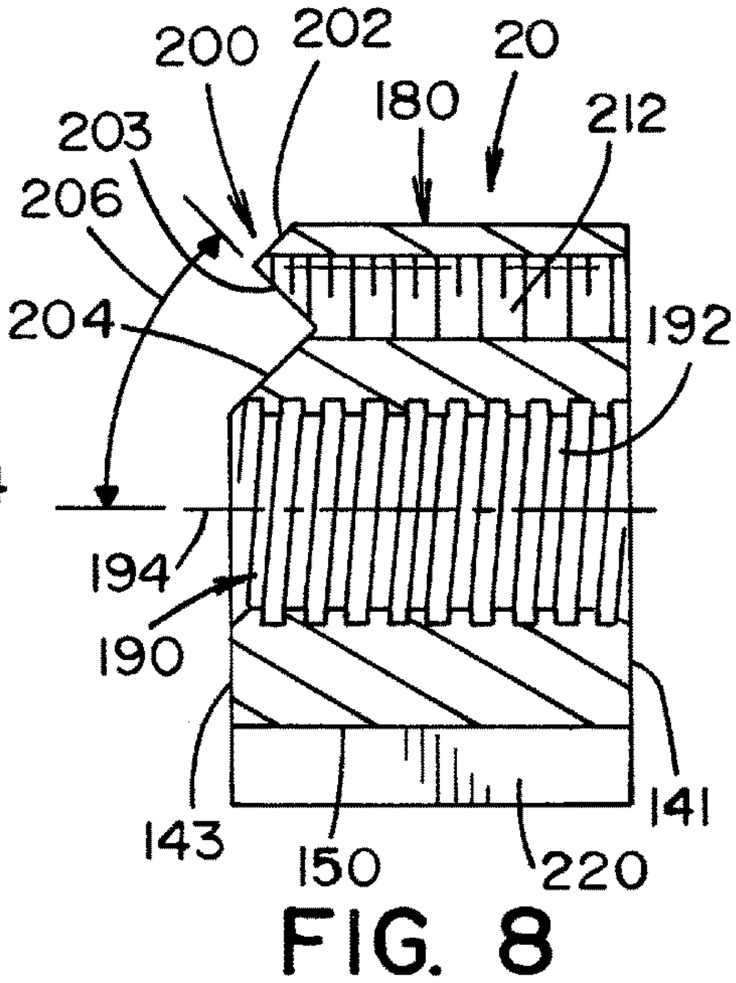

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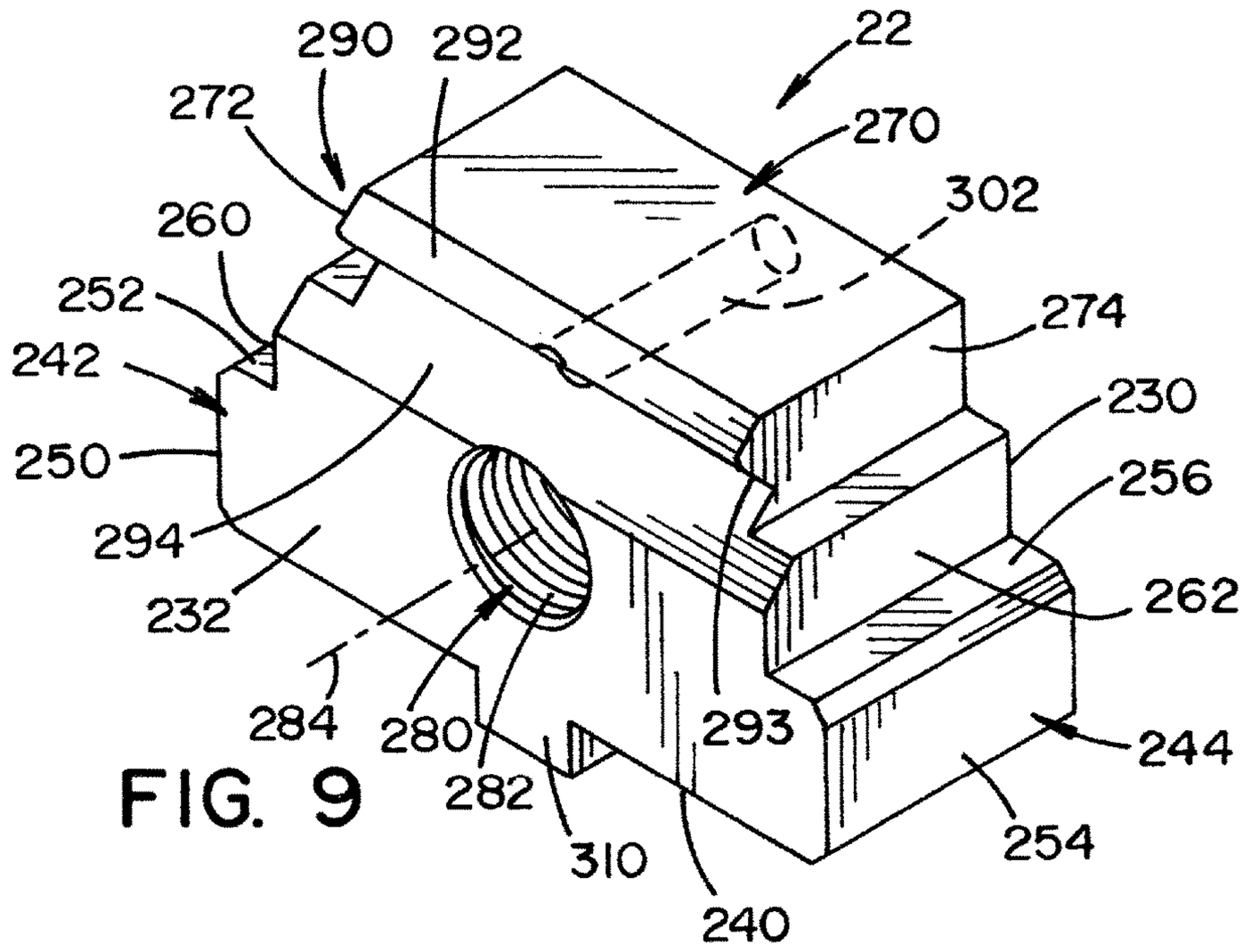

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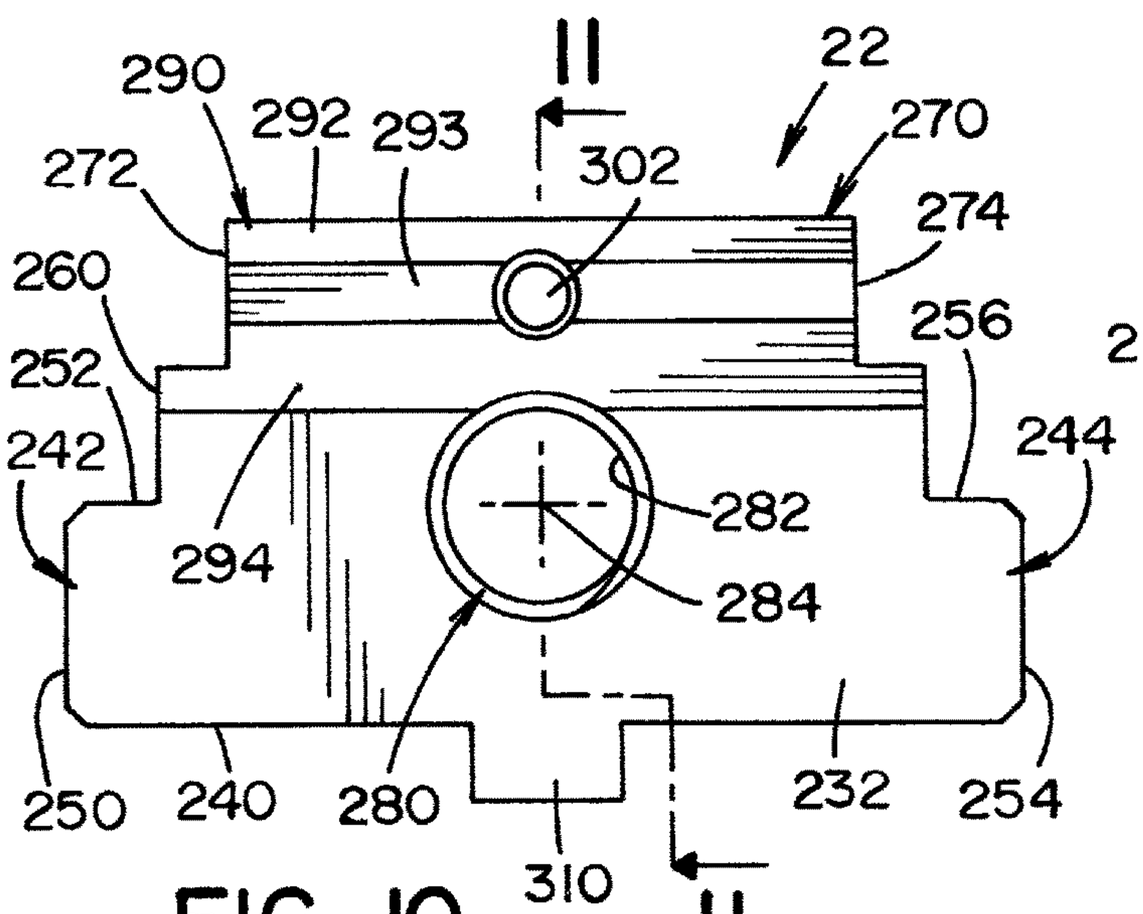

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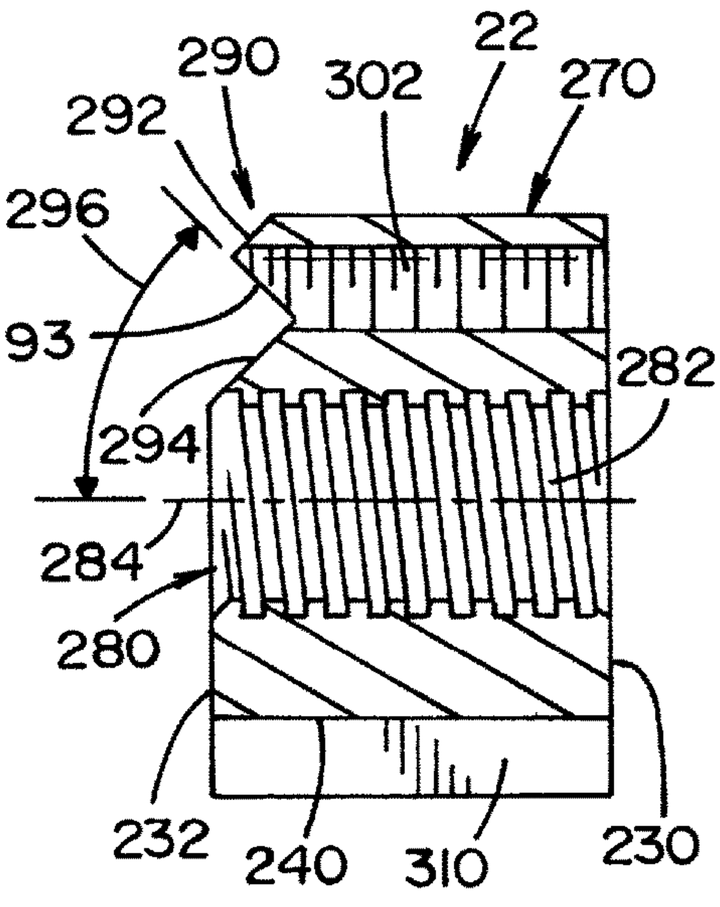

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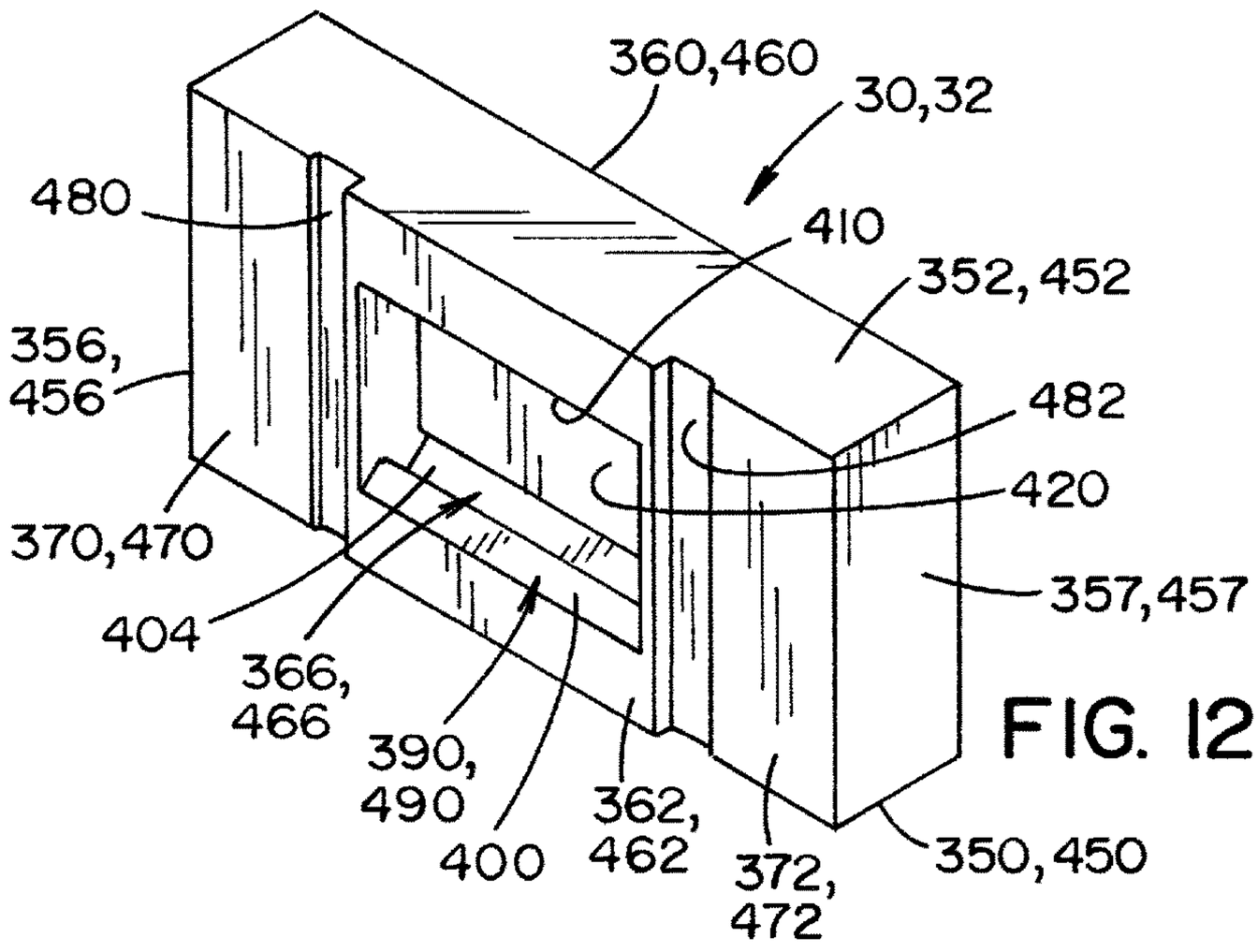

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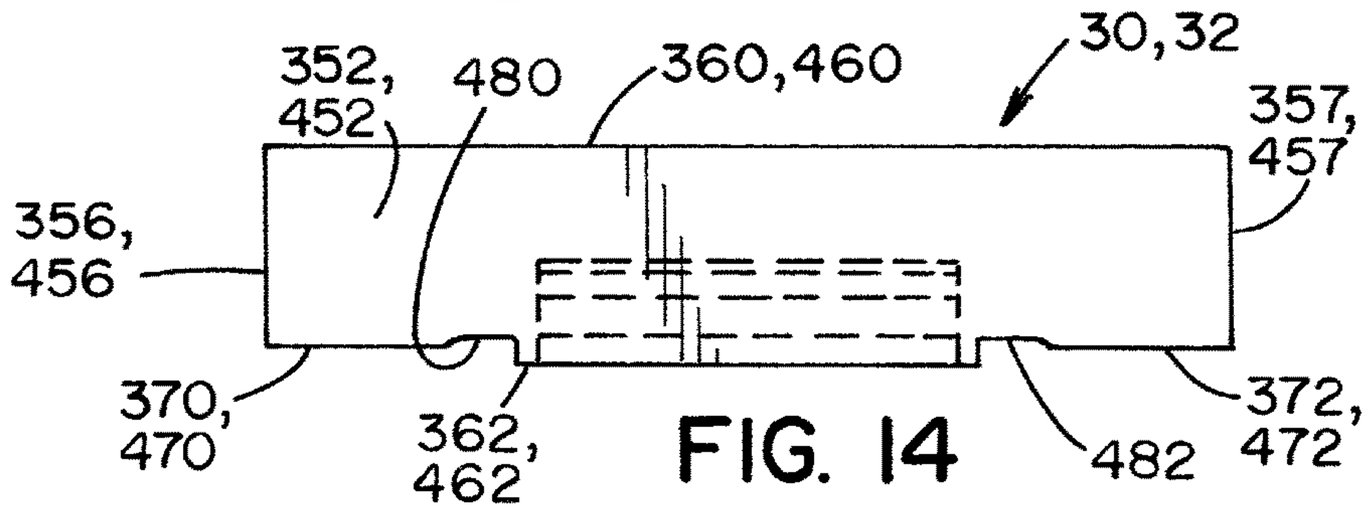

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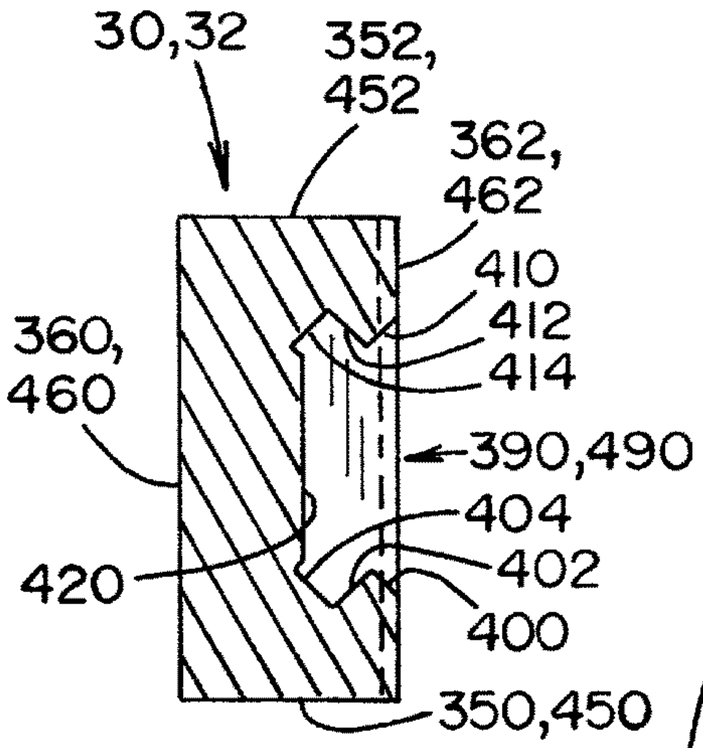

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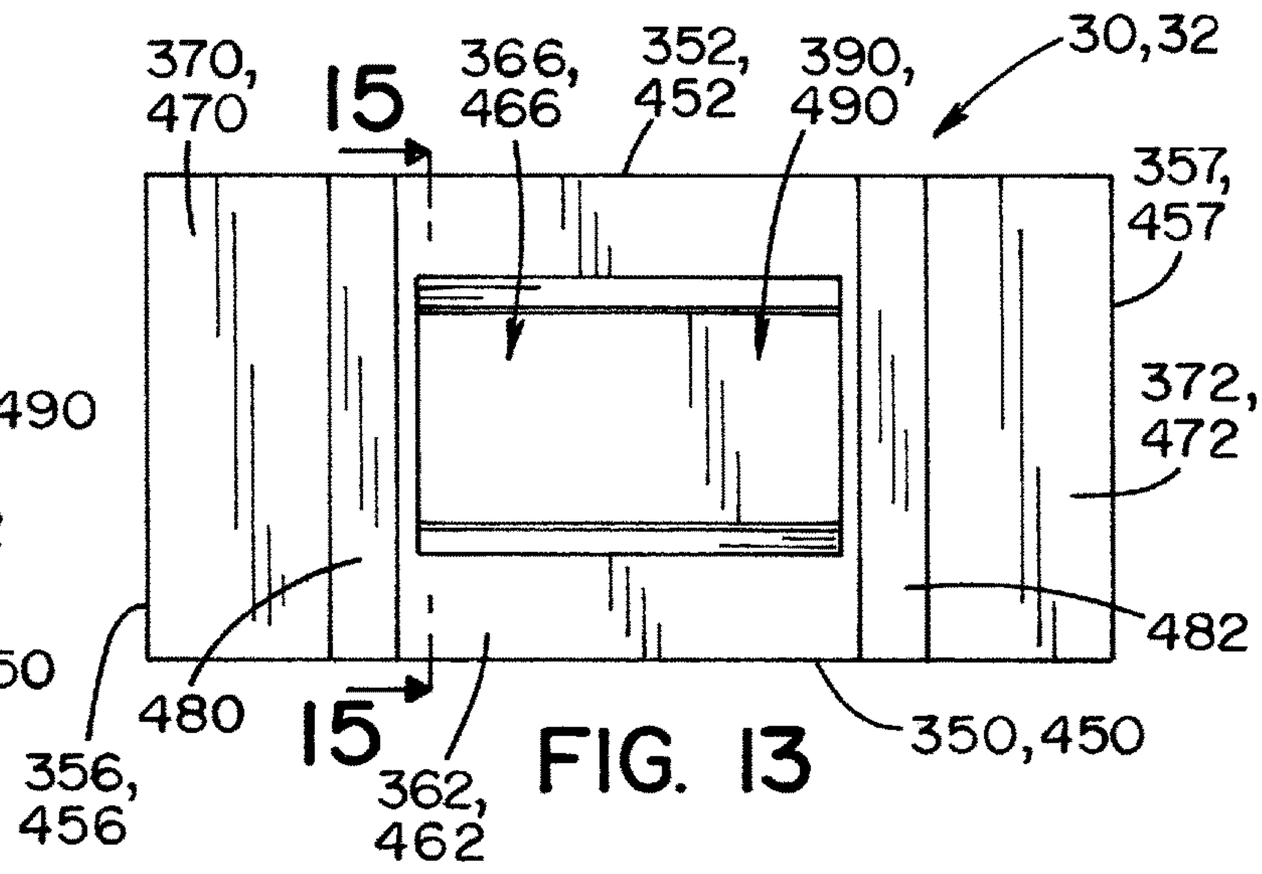

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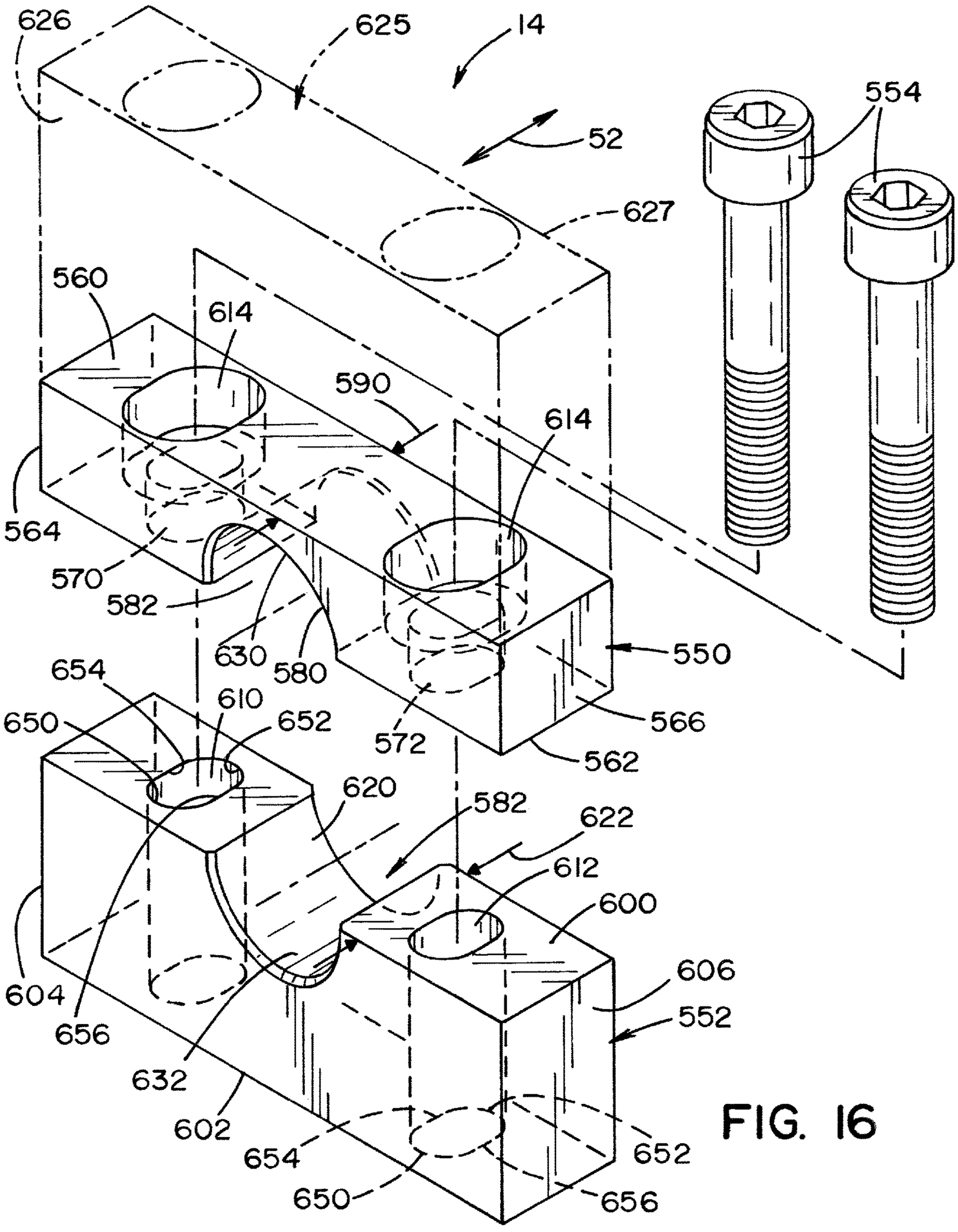
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FIG. 16

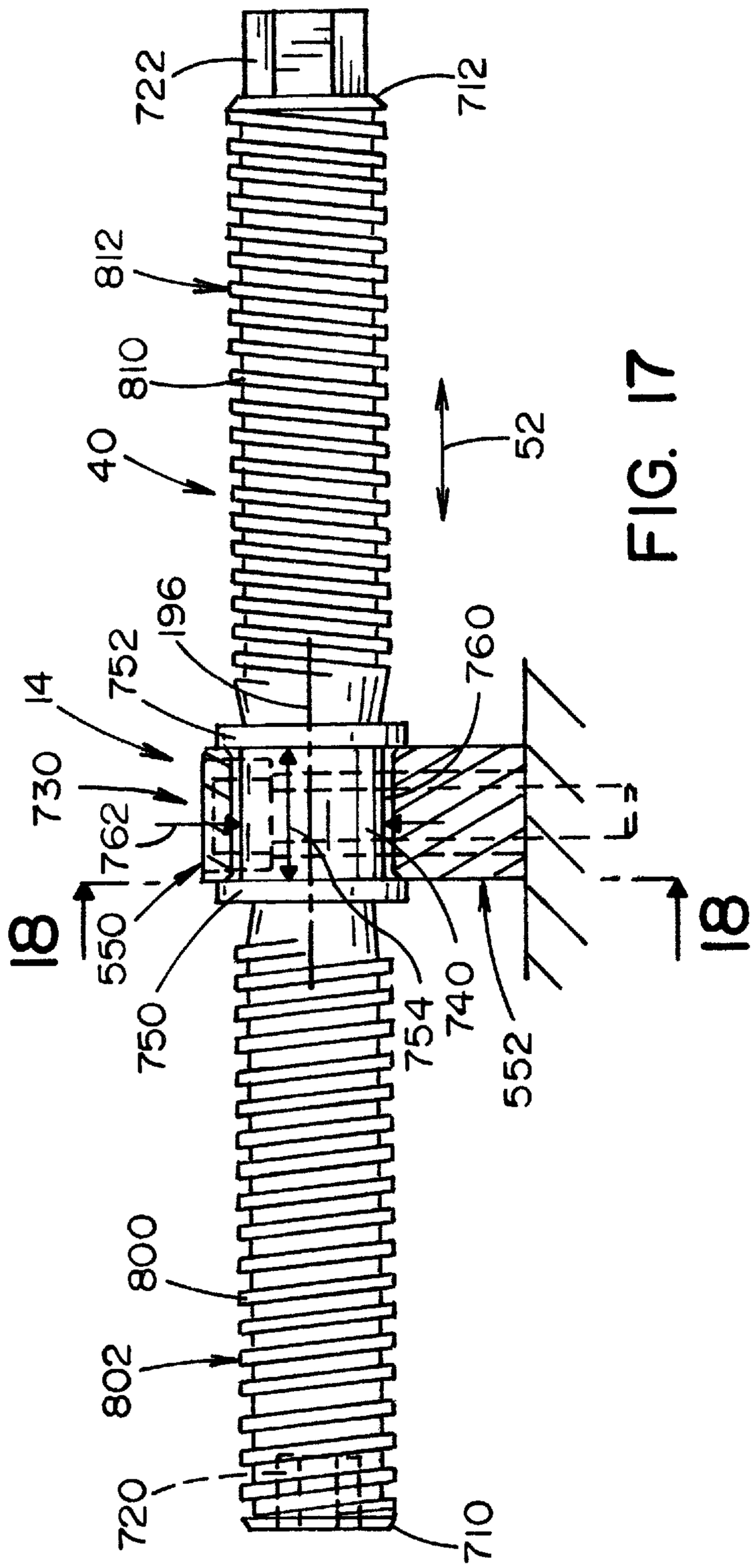
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FIG. 17

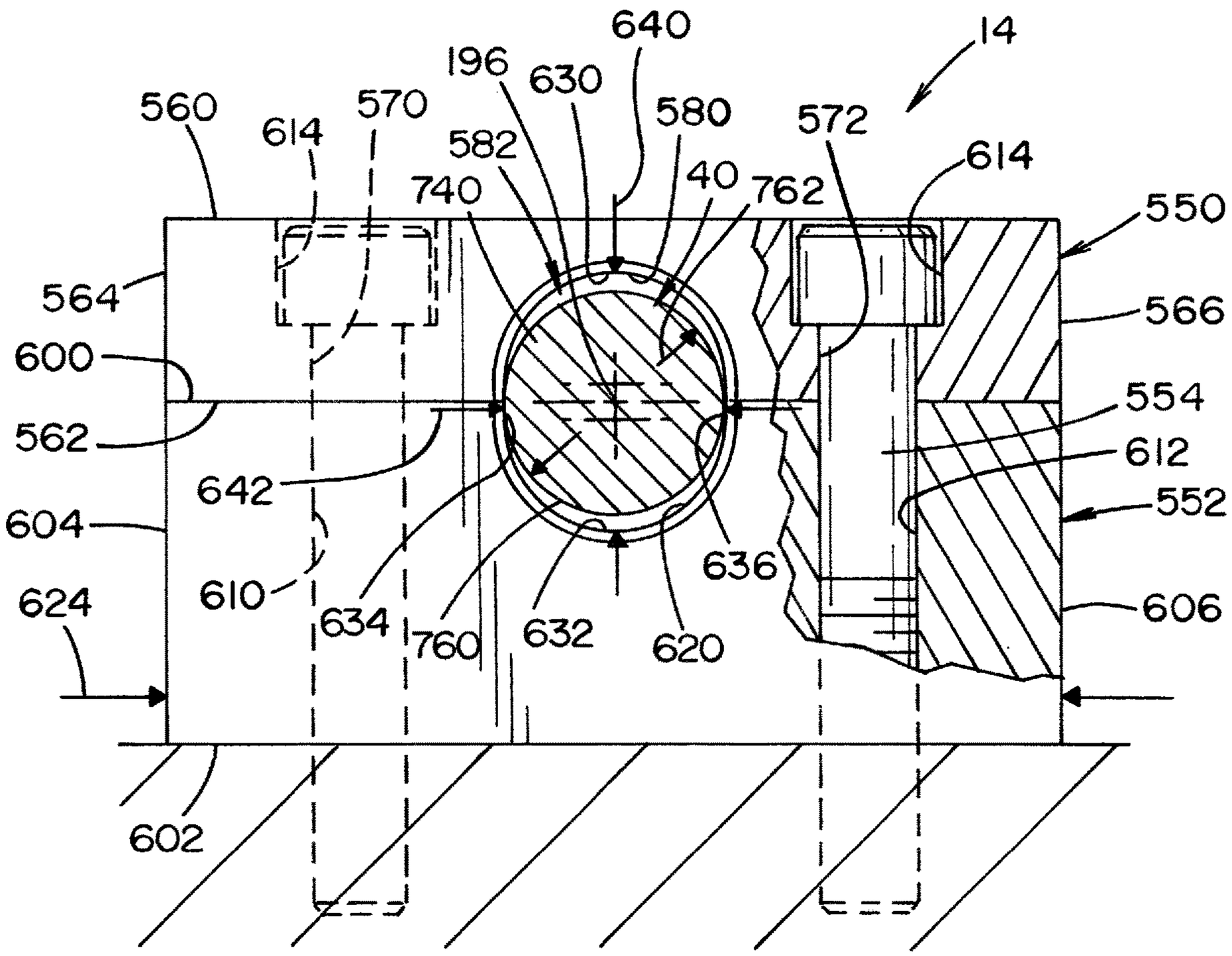
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FIG. 18

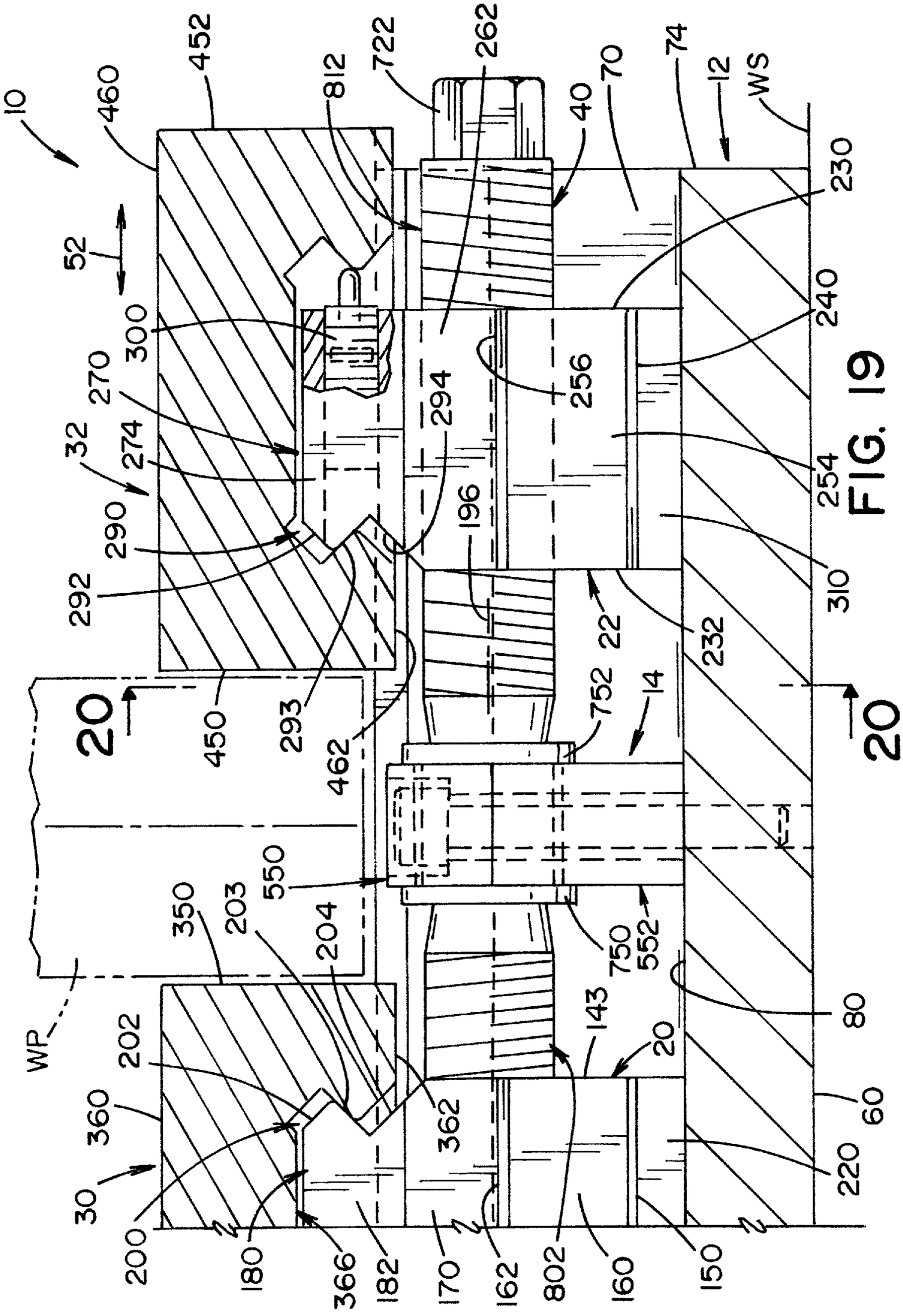
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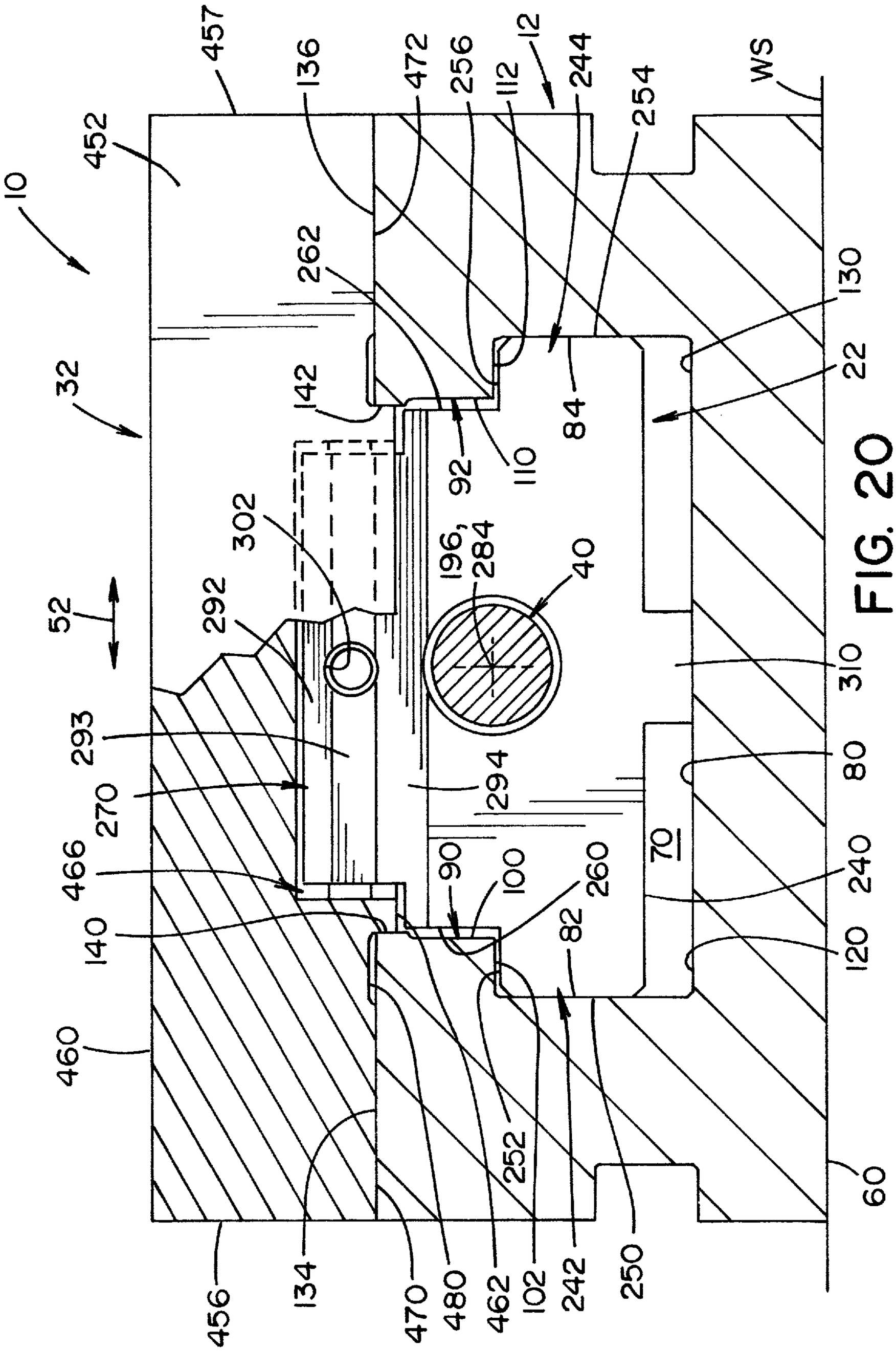
FIG. 19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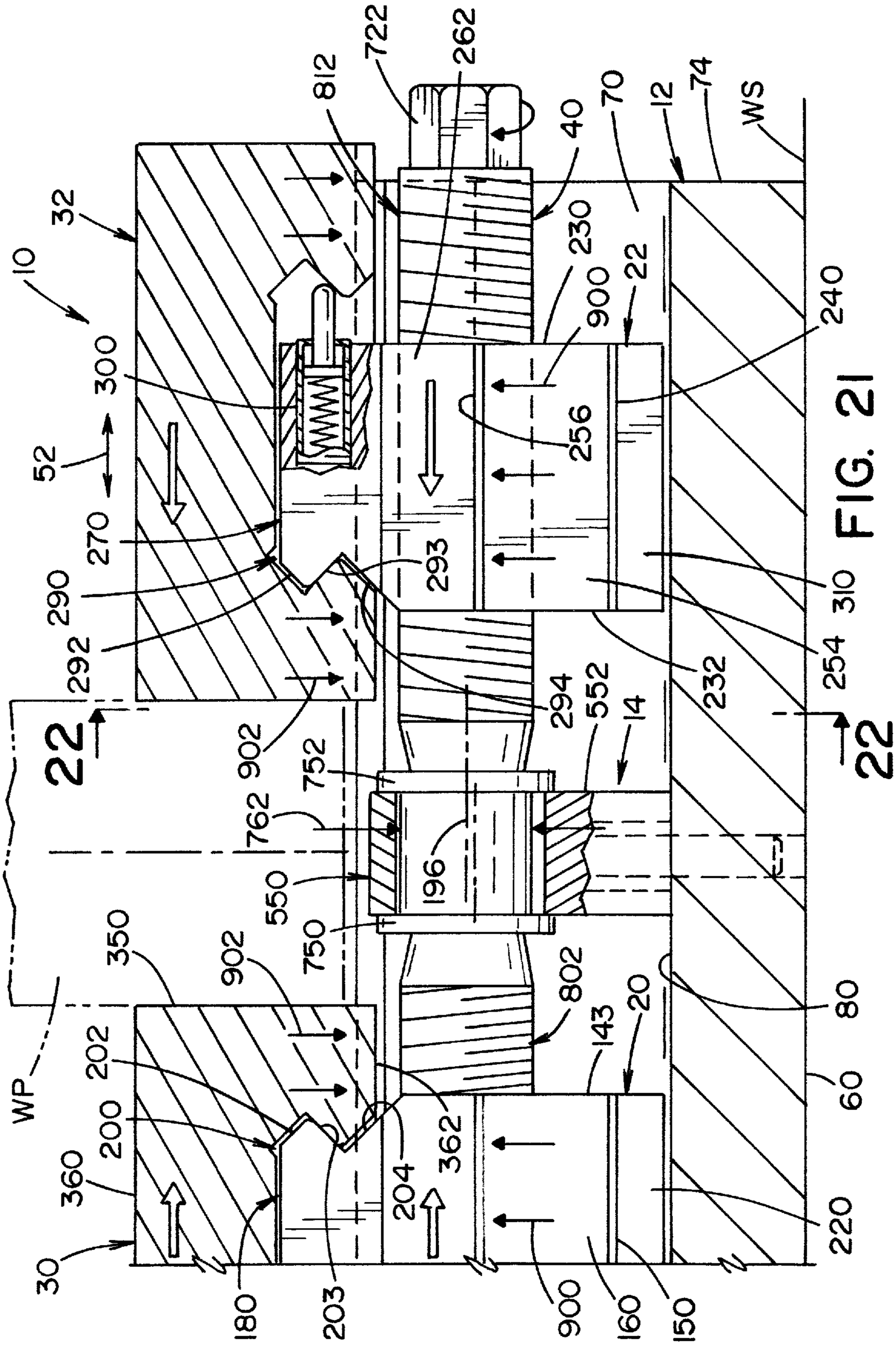
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FIG. 21

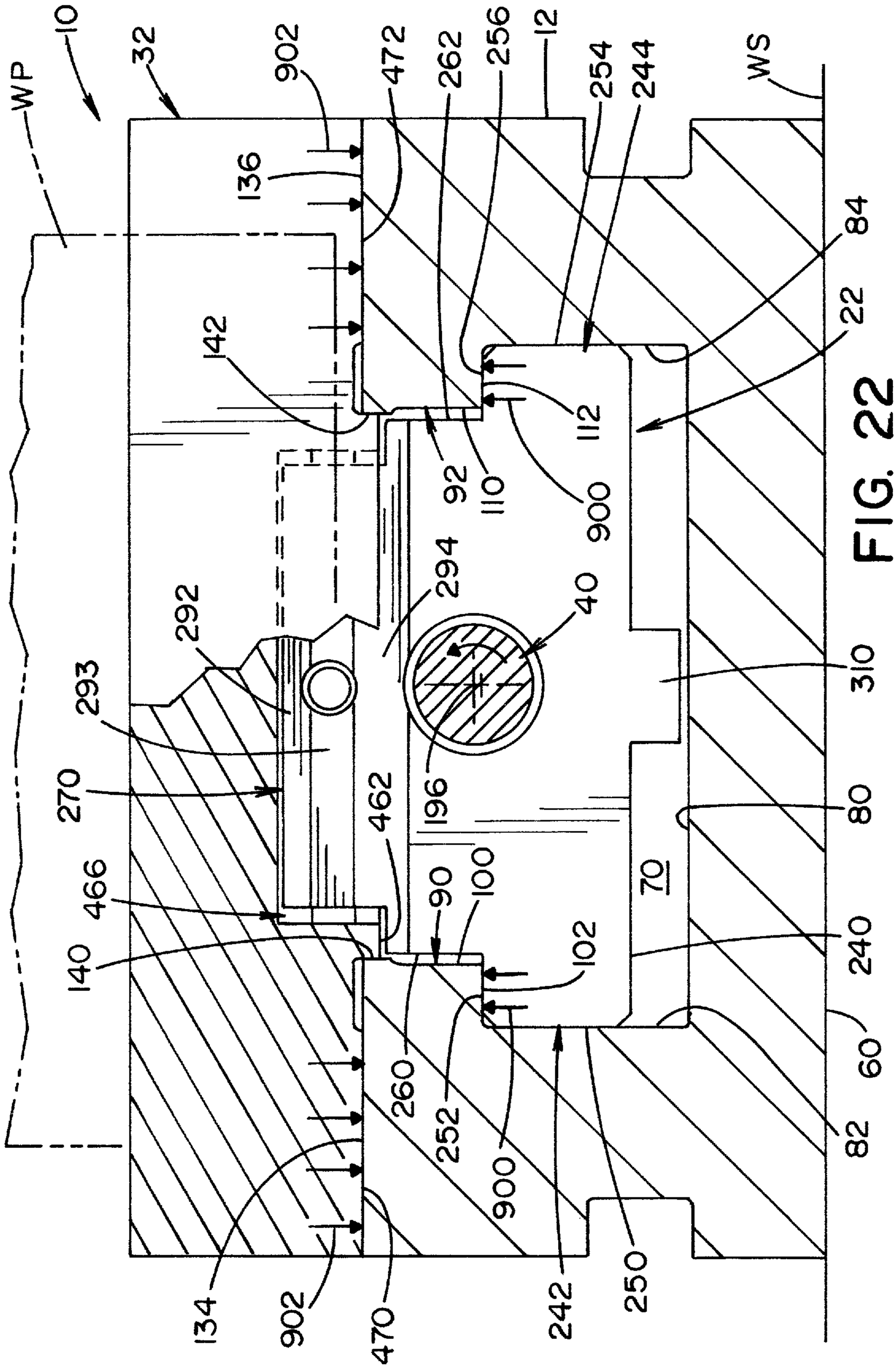
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FIG. 22

VISE

This application claims priority to provisional patent application Ser. No. 62/727,852 filed on Sep. 6, 2018, which is incorporated by reference herein.

The invention of this application relates to vises and, more particularly, to multiple jaw vises and, even more particularly, to self-centering vises, even more particularly to 5-axis machining and multi axis machining vises. It has also been found that the invention of this application can be used for multi-station vises. Yet even further, the invention of this application is well adapted for use with other tooling equipment, such as Applicant's FIXTURE PRO® line of products.

INCORPORATION BY REFERENCE

The invention of this application relates to vises and, more particularly, to multiple jaw vises that are self-centering. Multiple jaw vises and self-centering vises are known in the art. In particular, U.S. Pat. No. 5,649,694 to Buck discloses a multiple jaw vise and is incorporated by reference herein for showing the same. Similarly, U.S. Pat. No. 6,079,704 to Buck discloses a multiple jaw vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 6,139,001 to Buck discloses a multiple jaw vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 5,893,551 to Cousins et al. discloses a multiple jaw vise with machinable jaws and is incorporated by reference herein for showing the same. U.S. Pat. No. 5,098,073 to Lenz discloses a multiple jaw vise with a double threaded screw and is incorporated by reference herein for showing the same. U.S. Pat. No. 8,408,527 to Klingenberg et al. discloses a multi-jaw vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 9,095,958 to Schmidt discloses a self-centering dual direction clamping vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 9,296,089 to Schweigert et al. discloses a centric clamping vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 5,043,144 to Gordon et al. discloses a self-centering vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 9,364,937 to Taylor et al. discloses a centric clamping vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 2,564,138 to Walker discloses a machine vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 9,004,472 to Schmidt discloses a five axis machine vise and is incorporated by reference herein for showing the same. U.S. Pat. No. 8,020,877 to Lang discloses a self-centering chuck and is incorporated by reference herein for showing the same. U.S. Pat. No. 8,256,753 to Teo discloses a vise that prevents jaw lift and is incorporated by reference herein for showing the same. German Publication No. DE 202 11 275 (copy submitted herewith) discloses a self-centering vise and is incorporated by reference herein for showing the same. German Publication No. DE 10 2015 014 664 (copy submitted herewith) discloses a self-centering vise and is incorporated by reference herein for showing the same. Also incorporated by reference herein in its entirety is JERGENS Production Vise Catalog which is submitted herewith and forms part of this specification as does the above incorporation by reference documents.

BACKGROUND OF THE INVENTION

Vises are well known in the art and have evolved over the years. Further, multiple jaw vises and self-centering vises

are also known in the art and have been well received. In particular, the vises shown in many of the patents listed above, and incorporated by reference in this application as background material, have been well received in the marketplace. These patents disclose two jaw and self-centering vises that are effective and which have been used in industry for many years. However, many of these vises are costly to manufacture, are costly and difficult to maintain in the field, and can require many adjustments to function properly.

A self-centering vise is a vise that moves the workpiece being held to the center of the vise. This can improve accuracy and precision in the machining process wherein these vises are very popular. In that these vises center the workpiece, both jaws must move relative to the base and relative to one another to either provide an inwardly or an outwardly directed clamping force that is centered within the vise base. In that both jaws must move, there must be sufficient clearance between the jaws and the guides of the vise body. However, this "clearance" can produce jaw lift that reduces machining accuracies, which will be discussed more below. In order to move the jaws relative to one another, most prior art self-centering vises have a threaded rod or lead screw that is rotatable about a screw axis and that can rotate relative to the vise body. The lead screw has a center point and includes a right-handed external thread on one side of the center point and a left-handed external thread at the other side of the center point. The jaws include a first jaw that has a right-handed internal thread and a second jaw that has a left-handed internal thread wherein the jaws rotationally engage the threaded rod on either side of the center point. As a result, rotation of the rod in a first rotational direction about the rod or screw axis moves the jaws toward one another and toward the center. And, rotation of the rod in the other rotational direction moves the jaws away from one another and away from the center point. Thus, rotation of the threaded rod causes the jaws to move towards or away from each other.

In that the accuracy of the self-centering vise depends on the vise accurately centering and locating the workpiece each time, some self-centering vises include an adjustable center point.

One issue with multi-jaw vises is the "jaw lift" noted above. In greater detail, precision machining requires the workpieces to be maintained and repeatably located within strict tolerances. Jaw lift in a vise makes it difficult to maintain strict tolerances in the workpieces. Jaw lift is when the movable jaws of the vise lift as the jaws compress the workpiece relative to one another. Such 'jaw-lift' may result in, for example, a workpiece being slightly out of position relative to a known coordinate location of the milling machine. Moreover, jaw lift can also occur during machining. As referenced above, there needs to be enough clearance between the jaws and the guides of the vise body to allow the jaws to move and this clearance can produce the jaw lift.

In view of the importance of preventing jaw lift, some prior art vises have incorporated elaborate structures to control the clearances between the jaws and the guides to prevent jaw lift. In one particular vise, which has been well received in the industry, the vise incorporates an array of set screws and strategically placed pad arrangements to prevent the unwanted jaw lift. While this design can reduce jaw lift, it is time consuming, it requires the use of an additional tool and it adds another parameter into workholding geometry. In this respect, this system requires two set screw and two pad arrangements per moveable jaw. Thus, these vises include four set screws that must be tightened and loosened each time a workpiece is clamped in the vise. Moreover, these

four set screws must be manually loosened and then manually and accurately tightened each time the vise is used.

In greater detail, the four set screws engage four respective pads that are positioned below the jaws. When the set screws are tightened, they engage the pads and urge the jaw upwardly in the vise body guides. Each set screw urges one side of one of the jaws upwardly into one of the two vise body guides. The tightening of these two set screws removes the clearance between the vise body guides and one of the jaws in a known direction such that the jaw is forced against the upper guide surfaces of the vise body guides. Then, the same must be done to the other jaw since self-centering vises have two moveable jaws. This set screw tightening procedure must be done each time the jaws are adjusted or moved along the vise body guides. Then, before the jaws can be loosened or moved, all four set screws must be loosened to bring back the clearances that are needed to allow the jaws to move relative to the vise body guides.

As can be appreciated, this can be time consuming. And, it also requires a separate tool. Yet even further, the threads of the screws and/or threaded holes can become stripped if they are over tightened, which can make this feature inoperable and/or require expensive repairs. Moreover, in view of the time associated with tightening and then loosening the plurality of set screws, there is also the risk that this feature is not properly utilized by shop personnel.

Another issue is the centering of the jaws of the vise. In this respect, it is also important to set the center of the vise. Prior art vises includes means to make this adjustment, but it has been found that these systems can be ineffective, inaccurate, overly complicated and/or require special tools.

SUMMARY OF THE INVENTION

The invention of this application relates to vises and more particularly to multiple moveable jaw vises that overcome many of the shortcomings in the prior art. Even more particularly, the invention of this application relates to vise structures that have been found to work particularly well in connection with self-centering vises wherein the invention of this application will be discussed with specific reference to self-centering vises even though this application is not to be limited to a particular style of vise.

According to one aspect of the invention of this application, the vise includes one or more vise components configured to prevent jaw lift.

According to certain embodiments of the invention of this application, the vise includes vise trucks that move along a vise axis and vise jaws fixed relative to the vise trucks and wherein the vise jaws can automatically move relative to the vise trucks to urge the jaws toward the trucks when the vise is tightened and to allow the jaws to automatically move away from the trucks when the jaw is loosened.

According to yet other embodiments of the invention of this application, the vise includes a vise lead screw having a center point that rotates about a screw axis that is parallel to the vise axis wherein the vise trucks are on either side of the center point and move relative to the vise base when the lead screw is rotated about the screw axis. The lead screw being transversely displaceable relative to the screw axis to help facilitate the movement of the trucks relative to the vise jaws.

According to another aspect of the invention of this application, the vise includes one or more vise components configured to produce an efficient centering feature to center the moveable jaws within the jaw body.

According to certain embodiments of the invention of this application, the vise includes an axially displaceable pillow block assembly to provide selective unified displacement of the vise jaws, the vise trucks and the lead screw relative to the vise base along the vise axis.

These and other objects, aspects, features and advantages of the invention will become apparent to those skilled in the art upon a reading of the Detailed Description of the invention set forth below taken together with the drawings which will be described in the next section.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing, and more, will in part be obvious and in part be pointed out more fully hereinafter in conjunction with a written description of preferred embodiments of the present invention illustrated in the accompanying drawings in which:

FIG. **1** is a perspective view of a vise according to certain aspects of the present invention;

FIG. **2** is an exploded perspective view of the vise shown in FIG. **1**;

FIG. **3** is a top view of a vise body for the vise shown in FIG. **1**;

FIG. **4** is an end view of the vise body shown in FIG. **3**;

FIG. **5** is a sectional view along line **5-5** in FIG. **3**;

FIG. **6** is a perspective view of a first truck for the vise shown in FIG. **1**;

FIG. **7** is an elevational view of the first truck shown in FIG. **6**;

FIG. **8** is a sectional view taken along line **8-8** in FIG. **7**;

FIG. **9** is a perspective view of a second truck for the vise shown in FIG. **1**; and,

FIG. **10** is an elevational view of the second truck shown in FIG. **9**;

FIG. **11** is a sectional view taken along line **11-11** in FIG. **10**;

FIG. **12** is a bottom side perspective view of a jaw for the vise shown in FIG. **1**;

FIG. **13** is a bottom view of the jaw shown in FIG. **12**;

FIG. **14** is an elevational view of the jaw shown in FIG. **12**;

FIG. **15** is a sectional view taken along line **15-15** in FIG. **13**;

FIG. **16** is an exploded sectional view of a pillow block for the vise shown in FIG. **1**;

FIG. **17** is an elevational view of a lead screw for the vise shown in FIG. **1** with a sectional view of the pillow block;

FIG. **18** is a sectional view taken along line **18-18** in FIG. **17**;

FIG. **19** is a partial sectional view of the vise shown in FIG. **1** showing the jaws, trucks, pillow block and lead screw in a non-engagement position;

FIG. **20** is a sectional view taken along line **20-20** in FIG. **19**;

FIG. **21** is a partial sectional view of the vise shown in FIG. **1** showing the jaws, trucks, pillow block and lead screw in an engagement position; and,

FIG. **22** is a sectional view taken along line **22-22** in FIG. **20**.

DETAILED DESCRIPTION OF EMBODIMENTS

Referring now to the drawings wherein the showings are for the purpose of illustrating preferred and alternative embodiments of the invention only and not for the purpose of limiting the same, FIG. **1**—show a two jaw vise **10** which

generally includes a vise body or base **12**, a central pillow block assembly **14**, a first truck **20**, a second truck **22**, a first jaw **30**, a second jaw **32** and a lead screw **40**. The vise can further include a vise handle assembly **42**

As is known in the art, jaws **30** and **32** are configured to move relative to vise base **12** toward and away from one another and function to clamp a workpiece WP between the vise jaws. Again, while a specific vise configuration and vise base is shown, the invention of this application can be utilized in a wide range of vise configurations without detracting from the invention of this application including, but not limited to, a wide range of jaw configurations, single jaw vises, multiple jaw vises, multiple station vises, self-centering vises, 5-axis machining vises, multi axis machining vises and multi-station vises. Moreover, reference to directions and/or positions in this specification are in reference to the drawings only and are not to limit the invention of this application, including, but not limited to, top, bottom, upper, lower, middle, left, right.

Base **12** has a length **50** extending in a longitudinal direction **52** and a width **54** transverse to the longitudinal direction. Base **12** can be produced by any method known in the art including, but not limited to, a machined solid block, an extrusion and/or an assembly of separate parts without detracting from the invention. As is shown, base **12** is a machined solid block. Base **12** can include any mounting arrangement known in the art to secure the vise, which includes those found in the prior art.

Base **12** includes a base bottom **60** that can include the mounting arrangements reference above. Base **12** has a longitudinally extending guide channel **70** that can extend from a first vise end **72** to a second vise end **74**. Guide channel **70** is parallel to longitudinal direction **52** and can have a wide range of configurations without detracting from the invention of this application. As is shown, guide channel includes a bottom surface **80**, a first side surface **82** extending upwardly from one side of bottom surface **80** and a second side surface **84** extending upwardly from the other side of bottom surface **80**. Guide channel **70** further includes a first inwardly extending flange **90** above first side surface **82** and a second inwardly extending flange **92** above second side surface **84**. First flange **90** includes a first inwardly facing edge or surface **100** and a first downwardly facing edge or surface **102** and second flange **92** includes a second inwardly facing edge or surface **110** and a second downward edge or surface **112** wherein edges **100** and **110** face one another and wherein edges **102** and **112** are generally parallel to one another and face bottom surface **80**. In combination, first downward edge **102**, first side surface **82** and a first portion **120** of bottom surface **80** form a first truck channel **122**. Similarly, second downward edge **112**, second side surface **84** and a second portion **130** of bottom surface **80** form a second truck channel **132**. Moreover, the first and second flanges can include one or more chip flanges **140** and **142**, respectively, that can be used to maintain needed clearances when the vise is being used in a machining operation. Vise base **12** further includes a first base upper guide surface **134** on one side of guide channel **70** and a second base upper guide surface **136** on the other side of channel **70** that both extend longitudinally. As is shown, surfaces **134** and **136** are upwardly facing surfaces, which will be discussed more below.

First truck **20** has a first outside face **141** and a first inside face **143** longitudinally spaced from the first outside face when in an assembled condition as is shown in the illustrated embodiment. First truck **20** includes a bottom edge or surface **150** and oppositely extending first truck flanges **152** and **154** on either end of bottom edge **150**. Truck flange **152** includes an outer edge or surface **160** and an upper surface **162** and truck flange **154** includes an outer edge or surface **164** and an upper surface **166**. Extending upwardly from truck flange **152** is a guide surface **170** and extending upwardly from truck flange **154** is a guide surface **172** wherein guides surfaces **170** and **172** are generally parallel to one another. First truck **20** further includes a first jaw mount **180** that includes opposite side surfaces **182** and **184**. Below first jaw mount **180** is a first threaded lead screw opening **190** having a first truck lead screw thread **192**, which can be either a right hand or a left hand thread and which extends about first truck thread axis **194**. When in an assembled condition as is shown in FIG. **1**, first truck thread axis **194** is coaxial with a lead screw axis **196** of lead screw **40**, which will be discussed more below. First jaw mount **180** includes a first inwardly extending jaw lift control projection **200**, which will be discussed more below.

Jaw lift control projection **200** includes an upper control surface **202**, a middle control surface **203** and a lower control surface **204** that are angled relative to one another as is shown. Middle control surface **203** is at a control angle **206** relative to first truck thread axis **194**. Control angle **206** can be between 20 degrees and 70 degrees. More particularly, control angle **206** is between 30 degrees and 60 degrees. More particularly, control angle **206** is between 40 degrees and 50 degrees. In one embodiment, control angle **206** is about 45 degrees. Upper control surface **202** can also be parallel to lower control surface **204** and/or perpendicular to middle control surface **203**.

First truck **20** further includes a first spring plunger assembly **210** extending from outside face **141** and that extends from a spring plunger opening **212**. First spring plunger **210** can be any spring plunger (or the like) without detracting from the invention of this application and can be used in connection with surfaces **202-204** to secure the jaw relative to the truck while allowing controlled movement between the jaw and the truck. In addition, first truck **20** can include one or more first bottom ribs **220**. It has been found that first bottom rib **220** can be used to help first truck **20** work in the harsh environments associated with machining operations to prevent chips, which are produced from machining, from preventing movement or causing jamming of the truck within the guide channel. Moreover, it has been found that first rib **220** can also reduce lead screw flex during clamping and improve clamp load.

Second truck **22** can be like first truck **20**, but this is not required. In this respect and as is shown, second truck **22** has a second outside face **230** and a second inside face **232** longitudinally spaced from the second outside face when in the assembled condition. Second truck **22** includes a bottom edge or surface **240** and oppositely extending second truck flanges **242** and **244** on either end of bottom edge **240**. Truck flange **242** includes an outer edge or surface **250** and an upper surface **252** and truck flange **244** includes an outer edge or surface **254** and an upper surface **256**. Extending upwardly from truck flange **242** is a guide surface **260** and extending upwardly from truck flange **244** is a guide surface **262** wherein guides surfaces **260** and **262** are generally parallel to one another. Second truck **22** further includes a second jaw mount **270** that includes opposite side surfaces **272** and **274**. Below second jaw mount **270** is a second threaded lead screw opening **280** having a second truck lead screw thread **282**, which is coaxial with a second screw thread axis **284**. Truck thread **282** can be either a right hand or a left hand thread, but is preferably the opposite of first truck lead screw thread **192**. When in an assembled condi-

tion as is shown in FIG. **1**, second screw truck thread axis **284** is also coaxial with lead screw axis **196** of lead screw **40**, which will be discussed more below. Second jaw mount **270** includes a second inwardly extending jaw lift control projection **290**, which will be discussed more below.

Jaw lift projection **290** includes an upper control surface **292**, a middle control surface **293** and a lower control surface **294** that are angled relative to one another. Middle control surface **293** is at a control angle **296** relative to second screw truck thread axis **284**. Control angle **296** can be between 20 degrees and 70 degrees. More particularly, control angle **296** is between 30 degrees and 60 degrees. More particularly, control angle **296** is between 40 degrees and 50 degrees. In one embodiment, control angle **296** is about 45 degrees. Upper control surface **292** can also be parallel to lower control surface **294** and/or perpendicular to middle control surface **293**.

Second truck **22** further includes a second spring plunger assembly **300** extending from outside face **230** and that extends from a spring plunger opening **302**. Second spring plunger assembly **300** can be any spring plunger (or the like) and can be the same as spring plunger assembly **210** without detracting from the invention of this application. Second spring plunger assembly **300** can be used in connection with surfaces **292-294** to secure the jaw relative to the truck while allowing controlled movement between the jaw and the truck, which will be discussed in greater detail below. In addition, second truck **22** can include one or more second bottom ribs **310**. Again, it has been found that second bottom rib **310** can be used to help second jaw **22** work in the harsh environments associated with machining operations to prevent jamming of the truck within the guide channel. Moreover, the second rib **310** can reduce lead screw flex and improve clamp load.

First and second jaws **30** and **32** can have any known jaw configuration without detracting from the invention of this application wherein the jaws shown are for example only. Moreover, jaws **30** and **32** can be made from a wide range of materials without detracting from the invention of this application including, but not limited to, materials having different hardnesses.

In greater detail, first and second jaws **30** and **32** as are shown in the illustrated embodiments are identical; however, this is not required. In the interest of brevity, part of jaws **30** and **32** will be described together. includes a first jaw clamping surface or face **350** and a back face **352**. While clamping surface or face **350** is shown to be an inwardly facing surface, this is not required. First jaw **30** further includes first side jaw edges **356** and **357** that can be parallel to one another. First jaw **30** further includes a first jaw top **360** and a first jaw bottom **362**. First jaw **30** further includes a first truck mount **366** that is shaped to receive first jaw mount **180** discussed above. As is shown, first truck mount can be positioned relative to first jaw bottom **362**. First jaw **30** further includes two jaw guide surfaces **370** and **372**, which can be on either side of first truck mount **366**. Jaw guide surfaces **370** and **372** can include relief portions.

First truck mount **366** includes a first truck pocket **390** having a configuration to receive at least a portion of first jaw mount **180** and first inwardly extending jaw lift control projection **200**. First truck pocket **390** includes at least one lifting surface wherein the at least one lifting surface in the embodiments shown includes a front lower surface **400**, a front middle surface **402**, a front upper surface **404**, a rear lower surface **410**, a rear middle surface **412** and a rear upper surface **414**. First pocket **390** can further include a top surface **420** and one or more reliefs. As is shown, top surface **420** can join front upper surface **404** and rear upper surface **414**, but this is not required. Moreover, while many surfaces of this application are shown as planar surfaces, this is not required wherein they should not be limited to planar surfaces. While not required, front surfaces **400**, **402** and **404** can have the same or similar configuration as rear surfaces **410**, **412** and **414**. First truck mount **366** can extend from first jaw bottom **362** forming truck mount side surfaces, which can be configured to extend into guide channel **70** when in the assembled condition.

Again, the first and second jaws can be the same configuration as is shown in the drawings, but this is not required. As is shown, second jaw **32** includes a second jaw clamping surface or face **450** and a back face **452**. Again, while clamping surface or face **450** is shown to be an inwardly facing surface, this is not required. Second jaw **32** further includes second side jaw edges **456** and **457** that can be parallel to one another. Second jaw **32** further includes a second jaw top **460** and a second jaw bottom **462**. Second jaw **32** further includes a second truck mount **466** that is shaped to receive second jaw mount **270** discussed above. As is shown, second truck mount **466** can be positioned relative to second jaw bottom **462**. Second jaw **32** further includes two jaw guide surfaces **470** and **472**, which can be on either side of second truck mount **466**. Jaw guide surfaces **470** and **472** can include relief portions **480** and **482**, respectively.

Second truck mount **466** includes a second truck pocket **490** having a configuration to receive at least a portion of second jaw mount **270** and second inwardly extending jaw lift control projection **290**. Second truck pocket **490** includes at least one lifting surface wherein the at least one lifting surface in the embodiments shown includes the same surfaces as jaw **30**. As with jaw **30**, jaw **32** includes a front lower surface **400**, a front middle surface **402**, a front upper surface **404**, a rear lower surface **410**, a rear middle surface **412** and a rear upper surface **414**. Second pocket **490** can further include a top surface **420** and one or more reliefs. As is shown, top surface **420** can join front upper surface **404** and rear upper surface **414**, but this is not required. While not required, front surfaces **400**, **402** and **404** can have the same or similar configuration as rear surfaces **410**, **412** and **414**. Second truck mount **466** can extend from bottom second jaw bottom **462** forming truck mount side surfaces, which can be configured to extend within guide channel **70** when in the assembled condition.

Again, jaws **30** and **32** can have a wide range of configurations without detracting from the invention of this application wherein the drawings of this application merely show one of the many possible configurations.

Pillow block assembly **14** can have a wide range of configurations without detracting from the invention of this application as is the case for other structures of this application. As is shown in the illustrated embodiments, pillow block **14** has a two piece design having a top pillow block portion **550**, a bottom pillow block portion **552** and pillow block fasteners **554**. Top pillow block **550** includes a top pillow block upper edge **560**, a top block lower edge **562** and top block side edges **564** & **566**. Top pillow block **550** further includes top block fastener openings **570** and **572**. Top pillow block further includes a top block opening portion **580** of a lead screw opening **582**. Top block opening portion **580** extends inwardly from top block lower edge **562** and top block opening portion **580** is preferably centered in lower edge **562**, but this is not required. Top pillow block **550** has a top block thickness **590** at least near lead screw opening **582**.

Bottom pillow block **552** includes a bottom block upper edge **600**, a bottom block lower edge **602** and bottom block side edges **604** & **606**. Bottom pillow block **552** further includes bottom block fastener openings **610** and **612**. Bottom pillow block further includes a bottom block opening portion **620** of lead screw opening **582**. Bottom block opening portion **620** extends inwardly from bottom block upper edge **600** and bottom block opening portion **620** is preferably centered in upper edge **600**, but this is not required. Bottom pillow block **552** has a bottom block thickness **622** at least near lead screw opening **582**.

Top pillow block **550** and bottom pillow block **552** are configured to be securable relative to one another to form pillow block assembly **14** and are sized to allow pillow block assembly **14** to fit within guide channel **70**. This can include a pillow block assembly width **624** that allows the assembly to fit within guide channel **70** and selectively move within the channel as will be discussed more below. Moreover, top block fastener openings **570** and **572** and/or bottom block fastener openings **610** and **612** can be slotted openings in longitudinal direction **52** (when in the assembled condition shown in FIG. **1**) to allow selective and controlled longitudinal movement or adjustment of pillow block assembly **14** relative to vise base **12** in longitudinal direction **52** within guide channel **70**, which will also be discussed more below. Fastener openings **570** and **572** can further include a countersink **614**.

Yet even further, pillow block assembly **14** and/or vise **10** can include a center jaw **625** that can create a two workpiece vise design. In this set of embodiments, center jaw can include a first center jaw clamping surface or face **626** facing first jaw clamping surface or face **350** and a second center jaw clamping surface or face **627** facing second jaw clamping surface or face **450**. According, vise **10** can have two operable work stations wherein the first work station is between faces **626** and **350** and the second one is between faces **627** and **450**. Center jaw **625** can be a fixed jaw and can be centered in the same way as the pillow block assembly, which will be discussed more below. Center jaw **625** can come in a wide range of variations without detracting from the invention of this application. Moreover, center jaw **625** can be part of and/or extension of the central pillow block assembly and/or an attachment to the pillow block assembly. As is shown, center jaw **625** can be a modification of top pillow block **550** wherein the jaws and pillow blocks can be centered simultaneously as will be discussed more below.

Lead screw opening **582**, which is formed by top and bottom block opening portions **580** and **620**, can also be slotted to allow transverse movement of lead screw **40** relative to pillow block assembly **14** and longitudinal direction **52**. In greater detail, lead screw opening **582** includes a slotted configuration transverse to longitudinal direction **52**. Lead screw opening **582** includes a top screw arcuate portion **630** and a bottom screw arcuate portion **632** and upwardly extending opening screw side edges **634** & **636**, which extend between top screw arcuate portion **630** and bottom screw arcuate portion **632**. Top screw arcuate portion **630**, bottom screw arcuate portion **632** and screw side edges **634** & **636** define a lead screw opening height **640** and a lead screw opening width **642** wherein lead screw opening height **640** is greater than lead screw opening width **642**. In that opening side edges **634** & **636** are transverse to longitudinal direction **52** and lead screw opening height **640** is greater than lead screw opening width **642**, lead screw opening **582** is configured to allow selective transverse movement of lead screw **40** toward and away from base upper guide surfaces **134** and **136** to allow for controlled and limited transverse movement of the trucks and the jaws to prevent jaw lift, which will be discussed more below.

As is shown, fastener openings **570**, **572**, **610** and **612** include a slotted configuration parallel to longitudinal direction **52** when in the assembled condition. In greater detail, fastener openings **570**, **572** **610** and **612** include a first fastener arcuate portion **650** and a second fastener arcuate portion **652** and longitudinally extending opening fastener side edges **654** & **656**, which extend between first fastener arcuate portion **650** and second fastener arcuate portion **652**. In that side edges **654** & **656** are parallel to longitudinal direction **52**, they allow selective movement of pillow block assembly **14** in the longitudinal direction and, thus, lead screw **40** in longitudinal direction **52** when pillow block fasteners **554** are loosened. This in turn produces selective and unified movement of the trucks and the jaws with the pillow block and the lead screw in the longitudinal direction. This unified longitudinal movement of the pillow block assembly, lead screw, trucks and jaws can be used to adjust or calibrate the center point of the lead screw relative to the vise base, which will be discussed more below.

Lead screw **40** extends in longitudinal direction **52** wherein lead screw axis **196** is at least generally parallel to longitudinal direction **52** and forms a vise axis. However, as will be discussed more below, the controlled transverse movement of the jaws and/or trucks to prevent jaw lift could result in the lead screw axis being at least slightly unparalleled to longitudinal direction **52**. Lead screw **40** extends between a first lead screw end **710** to a second lead screw end **712**. First lead screw end **710** can include a first tool engaging configuration **720** and second lead screw end can include a second tool engaging configuration **722**. First and second tool engaging configurations **720** and **722** can be the same configuration and/or can include different configurations as is shown in the drawings. As is shown, first tool engaging configuration is a hex socket head and second tool engaging configuration is a hex head. Vise handle assembly **42** can be configured to engage first and/or second tool engaging configurations and can be any handle assembly known in the art without detracting from the invention of this application.

Lead screw **40** further includes a center point **730** between first and second ends **710** and **712**. Center point **730** can be an adjustable center point based on the adjustability of pillow block assembly **14**, which will be discussed more below. Lead screw **40** further includes a longitudinally extending central groove **740**, which is preferably cylindrical. Groove **740** is shaped to be received within lead screw opening **582** wherein the slotted configuration of lead screw opening **582** allows for the transverse movement of lead screw **40** as referenced above and which will be discussed more below. Central groove **740** is coaxial with lead screw axis **196** and includes a first groove wall **750** and a second groove wall **752** that is axially spaced from first groove wall **750** by a groove spacing **754**. Groove spacing **754** is larger than pillow block assembly width **590**, **622** to allow pillow block assembly **14** to capture and secure lead screw **40** longitudinally within central groove **740**, but allow relative rotation of lead screw **40** about lead screw axis **196**. Preferably, groove spacing **754** is only slightly larger than pillow block assembly **14** width **590**, **622** to limit unwanted longitudinal movement of lead screw **40**. Central groove **740** can further include a cylindrical groove bearing surface **760** having a groove diameter **762** between the groove walls. Groove diameter **762** can be closely sized to lead screw opening width **642** to allow controlled rotation of the lead

screw about the lead screw axis, but less than lead screw opening height **640** to allow for the transverse movement of lead screw **40** relative to block **14** and base **12**. Lead screw **40** includes a first screw thread **800** on a first screw side **802** and a second screw thread **810** on a second screw side **812**. First screw thread **800** is configured to threadingly engage with first truck lead screw thread **192** of first threaded lead screw opening **190** of first truck **20**. Similarly, second screw thread **810** is configured to threadingly engage with second truck lead screw thread **282** of second threaded lead screw opening **280** of second truck **22**. These threaded engagements produce longitudinal movement of the first and second trucks toward one another when lead screw **40** is rotated about lead screw axis **196** in a first rotational direction **820** and away from one another when rotated in a second rotational direction **822**. Movement of the trucks in turn produces movement of the first and second jaws. Similarly, movement of the jaws can produce movement of the trucks.

In operation, vise **10** is positioned on a work surface WS. As noted above, any mounting feature and/or configuration known in the art can be used to secure vise base **12** of vise **10** relative to the work surface. Once secured to the work surface, pillow block fasteners **554** can be loosened to allow pillow block assembly **14** to be selectively moved in longitudinal direction **52**. This movement can be used to adjust center point **730** of lead screw **40** and the vise as is desired to center the vise on the work surface. In that lead screw is held relative to the pillow block assembly longitudinally, longitudinal movement of the pillow block moves lead screw **40** longitudinally. Moreover, the longitudinal movement of lead screw **40** also moves trucks **20** & **22** and jaws **30** & **32** together in the longitudinal direction. Similarly, when pillow block fasteners **554** are loose, movement of jaws **30** & **32** can move trucks **20** & **22**, which in turn will move lead screw **40**, which will move pillow block assembly **14**. According to one set of embodiments, vise base **12** can further include center alignments openings **850** and **852**. Center alignments openings **850** and **852** can be shaped to receive alignment dowels or pins **860**. In this embodiment, the vise can be quickly and accurately centered with the use of pins **860**. In this respect, once vise **10** is positioned on the work surface, pins **860** are positioned into alignments openings **850** and **852** and pillow block fasteners **554** are loosened. Then, lead screw **40** can be rotated to move jaws **30** & **32** toward the center point and toward pins **860** in openings **850** and **852**. As jaws **30** & **32** approach pins **860**, one of the jaws will engage pins **860** first if the jaws are not centered. In that pillow block fasteners **554** are loose, the engagement between the one jaw and pin **860** will stop the inward movement of the one jaw and urge the other jaw toward the pins, which will move pillow block **14** toward the center of the vise. Continued tightening of the lead screw until both jaws are firmly engaged against either side of pins **860** will automatically center the pillow block assembly, the lead screw, the trucks, and the jaws. Once in the centered position, pillow block fasteners **554** can be tightened to maintain the pillow block assembly, lead screw, trucks and jaws in the centered position. Therefore, this movement can be used to center the jaws relative to the vise and; therefore, the work surface being used. Yet even further, it has been found that accuracy is further improved if pins **860** are cylindrical. In this respect, by utilizing cylindrical pins, each jaw/pin engagement point is in point contact wherein each jaw has two repeatable points of contact with the two pins.

Once vise **10** is in the desired operating position and centered, a workpiece WP can be positioned relative to the vise, which is shown in FIGS. **19** & **20**. Once in position, lead screw **40** is rotated (based on the drawings of this application) in first rotational direction **820** to urge the jaws toward one another to "tighten" the jaws on the workpiece toward the position shown in FIGS. **21** & **22**. As the jaws engage the work piece, first inwardly extending jaw lift control projection **200** engages first truck pocket **390** of first jaw **30** to create controlled truck lift **900** in first truck **20**. Similarly, second inwardly extending jaw lift control projection **290** engages second truck pocket **490** to create controlled truck lift **900** in second truck **22**. Continued tightening of the jaws then produces controlled and repeatable truck lift **900** for both trucks as is shown in FIGS. **21** & **22**. In this respect, inward movement of the trucks urges the trucks toward one another in guide channel **70** even after jaws **30** and **32** engage the workpiece thereby causing movement of the trucks relative to the jaws in the longitudinal direction. This causes engagement between at least one front surfaces (**400**, **402**, **404**) of first truck pocket **390** of the first jaw and at least one control surfaces **202-204** of first inwardly extending jaw lift control projection **200** of the first truck. The angled surfaces cause first truck **20** to lift within guide channel **70** in direction **900** until upper surfaces **162** and **166** of the truck flanges engage downward edges or surfaces **112** and **102** of guide channel **70**, respectively. Continued tightening of the trucks will seat upper surfaces **162** and **166** against the downward surfaces **112** and **102** thereby preventing any lift of the first truck during machining of the work piece. Similarly, inward movement of the second jaw causes engagement between at least one front surfaces (**400**, **402**, **404**) of second truck pocket **490** of the second jaw and at least one control surfaces **292-294** of second inwardly extending jaw lift control projection **290** of the second truck. The angled surfaces cause second truck **22** to lift within guide channel **70** in direction **900** until upper surfaces **252** and **256** of the truck flanges engage downward edges or surfaces **102** and **112** of guide channel **70**, respectively. Continued tightening of the trucks will seat upper surfaces **252** and **256** against the downward surfaces **102** and **112** thereby preventing any lift of second truck during machining of the work piece.

In addition, the jaws can be configured to also take advantage of the lift control projections. In this respect, the engagement of first inwardly extending jaw lift control projection **200** against first truck pocket **390** of first jaw **30** can also create jaw pull down **902** in first jaw **20**. Similarly, the engagement of second inwardly extending jaw lift control projection **290** against second truck pocket **490** can create jaw pull down **902** in second jaw **22**. Continued tightening of the jaws then produces controlled and repeatable pull down **902** of the jaws. Again, inward movement of the trucks urges the trucks toward one another in guide channel **70** even after jaws **30** and **32** engage the workpiece thereby causing movement of the trucks relative to the jaws in the longitudinal direction. This causes the engagement between at least one front surfaces (**400**, **402**, **404**) of first truck pocket **390** of the first jaw and at least one control surfaces **202-204** of first inwardly extending jaw lift control projection **200** of the first truck. The angled surfaces can also cause first jaw **30** to be pulled down toward guide channel **70** until jaw guide surfaces **370** and **372** of first jaw **30** engage first and second base upper guide surfaces **136** and **134**, respectively. Continued tightening of the trucks will seat the jaw guide surfaces against the upper guide surfaces of the base. Similarly, inward movement of the second jaw causes engagement between at least one of front surfaces (**400**, **402**, **404**) of second truck pocket **490** of the second jaw and at least one of control surfaces **292-294** of second

inwardly extending jaw lift control projection **290** of the second truck. The angled surfaces cause second jaw **32** to be pulled down toward guide channel **70** until jaw guide surfaces **470** and **472** of second jaw **32** engage first and second base upper guide surfaces **134** and **136**. Continued tightening of the trucks will seat the jaw guide surfaces against the upper guide surfaces of the vise base.

The truck lift and the jaw pull down can also work together to securely pinch the first and second inwardly extending flanges **90** and **92** between the jaws and the trucks. Moreover, the slotted shape of lead screw opening **582** helps facilitate this pinching action between the jaws, the trucks and the guide channel and prevents bending of the lead screw by allowing it to float and allows greater tightening forces to be applied to the workpiece. In this respect, the truck lift produced during jaw tightening produces upward movement of the trucks relative to the base that is transverse to direction **52**, which in turn moves first truck screw thread axis **194** of first truck **20** and second truck screw thread axis **284** of second truck away from guide surface **80** of guide channel **70**. By having a slotted lead screw opening **582**, lead screw **40** can freely move with the trucks thereby reducing bending in the lead screw thereby increasing the pinching effect of the jaws and trucks and increasing the holding force of the vise in view of the reduced friction. Moreover, the pinching effect of the components significantly reduces jaw lift in the vise and does so automatically when the vise is tightened.

Again, rotation of the lead screw in the first rotational direction moves the jaw(s) and the truck(s) from a non-engagement position shown in FIGS. **19** & **20** wherein the jaw clamping surface(s) is spaced from the workpiece, an engaging position wherein the jaw clamping surface(s) is engaging the associated workpiece and a fully engaged position shown in FIGS. **21** & **22** wherein the jaw clamping surface(s) is tightened against the associated workpiece. When in the non-engagement position, the jaw(s) being movable relative to the truck(s) and the vise having a movement clearance between the upper truck surfaces and the base flange bottom surface allowing longitudinal movement of the truck(s) relative to the vise base. When in the engaging position, engagement between the jaw clamping surface(s) of the jaw(s) and the workpiece urging the at least one lifting surface of the jaw(s) against the lift control projection thereby urging the upper truck surface toward the base flange bottom surface(s) and wherein the jaw(s) moves relative to the truck(s) transversely to the longitudinal direction. When in the fully engaged position, the upper truck surface(s) engaging the base flange bottom surface(s) and the jaw(s) being fixed relative to the truck(s).

While not shown, the vise according to the present invention can be used for any known application, and even newly found applications, for these styles of vises. This includes, but is not limited to, powered versions of these vises wherein hand crank **42** is replaced with a powered crank (not shown). Further, the vise according to the present invention could be incorporated as a component of a clamping system without detracting from the invention of this application.

While considerable emphasis has been placed on the preferred embodiments of the invention illustrated and described herein, it will be appreciated that other embodiments, and equivalences thereof, can be made and that many changes can be made in the preferred embodiments without departing from the principles of the invention. Furthermore, the embodiments described above can be combined to form yet other embodiments of the invention of this application. Accordingly, it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the invention and not as a limitation.

It is claimed:

1. A vise for holding a workpiece that reduces jaw lift, the vise comprising:

a vise base having a base length extending in a longitudinal direction and a base width transverse to the longitudinal direction, the vise base having a base bottom to support the vise base on an associated underlying surface, the vise base further including a longitudinally extending guide channel that includes a first inwardly extending base flange and a second inwardly extending base flange, the first inwardly extending flange having a first base flange bottom surface and the second inwardly extending base flange having a second base flange bottom surface;

at least one truck that is shaped to be received in the longitudinally extending guide channel for selective longitudinal movement in the longitudinal direction, the at least one truck having a first truck flange and a second truck flange opposite of the first truck flange, the first and second truck flanges being shaped to be received by the longitudinally extending guide channel for the selective longitudinal movement, the first truck flange having a first upper truck surface and the second truck flange having a second upper truck surface wherein the first upper truck surface faces the first base flange bottom surface and the second upper truck surface faces the second base flange bottom surface, the at least one truck further including a threaded truck lead screw opening having a truck lead screw thread, the at least one truck having a jaw mount that includes a truck lift surface;

at least one jaw that is selectively securable relative to the at least one truck, the at least one jaw including a jaw clamping surface extending in the longitudinal direction and configured to engage an associated workpiece, the at least one jaw further including a truck mount that is shaped to receive the jaw mount of the at least one truck, the truck mount having a jaw lift surface;

a lead screw that extends in the longitudinal direction and is selectively rotatable about a lead screw axis, the lead screw having a screw thread coaxial with the lead screw axis and operably connected to the truck lead screw thread wherein rotation of the lead screw in a first rotational direction moves the at least one jaw and the at least one truck toward the associated workpiece and rotation of the lead screw in a second rotational direction moves the at least one jaw and the at least one truck away from the associated workpiece;

wherein rotation of the lead screw in the first rotational direction moves the at least one jaw and the at least one truck from a non-engagement position wherein the jaw clamping surface is spaced from the associated workpiece toward an engaging position wherein the jaw clamping surface engages the associated workpiece and a fully engaged position wherein the jaw clamping surface is tightened against the associated workpiece;

when in the non-engagement position, the at least one jaw being movable relative to the at least one truck transversely to the longitudinal direction and the vise having a movement clearance that is a gap between the first upper truck surface and the first base flange bottom surface allowing the longitudinal movement of the at least one truck relative to the vise base; when in the engaging position, engagement between the jaw clamp-

ing surface of the at least one jaw and the associated workpiece urging the jaw lift surface against the truck lift surface thereby urging the first upper truck surface toward the first base flange bottom surface and wherein the at least one truck moves relative to the at least one jaw transversely to the longitudinal direction; when in the fully engaged position, the first upper truck surface engaging the first base flange bottom surface and the at least one jaw being fixed relative to the at least one truck;

wherein the at least one truck includes a first truck and a second truck, the at least one jaw includes a first jaw and a second jaw; the first jaw having a first clamping surface and the second jaw having a second clamping surface; the vise further including a pillow block, the pillow block being securable relative to the vise base between the first and second trucks, the pillow block having a lead screw opening that is shaped to receive the lead screw, the lead screw opening being elongated to allow movement of the lead screw relative to the pillow block that is transverse to the longitudinal direction, wherein when in the engaging position, the engagement between the first and second jaw clamping surfaces of the first and second jaws and the associated workpiece moves the first and second trucks and the lead screw transversely to the longitudinal direction.

2. The vise according to claim **1**, wherein when in the non-engagement position, the vise having the movement clearance between the first and second upper truck surfaces and the first and second base flange bottom surfaces respectively allowing the longitudinal movement of the first and second trucks relative to the vise base; when in the engaging position, the engagement between the first and second jaw clamping surfaces of the first and second jaws and the associated workpiece urging the first and second upper truck surfaces toward the first and second base flange bottom surfaces respectively and wherein the first and second trucks move relative to the first and second jaws respectively transversely to the longitudinal direction; when in the fully engaged position, the first and second upper truck surfaces seating against the first and second base flange bottom surfaces respectively and the at least one jaw being fixed relative to the at least one truck.

3. The vise according to claim **1**, wherein the first and second trucks include a lift control projection, the truck lift surface being part of the lift control projection.

4. The vise according to claim **3**, wherein the truck mount is a pocket in the at least one jaw having the jaw lift surface.

5. The vise according to claim **1**, wherein the first and second jaw clamping surfaces face each other.

6. The vise according to claim **1**, wherein the first and second jaw clamping surfaces face away from each other.

7. The vise according to claim **1**, wherein the lead screw has a lead screw groove including a first groove wall and an opposite second groove wall, the lead screw groove being shaped to lock the lead screw relative to the pillow block longitudinally between the first and second groove walls.

8. The vise according to claim **1**, wherein when in the non-engagement position, the vise having the movement clearance between the first and second upper truck surfaces and the first and second base flange bottom surfaces respectively allowing the longitudinal movement of the first and second trucks relative to the vise base; when in the engaging position, the engagement between the jaw clamping surfaces of the first and second jaws and the associated workpiece urging the first and second upper truck surfaces toward the first and second base flange bottom surfaces respectively; and wherein the first and second trucks move relative to the first and second jaws respectively transversely to the longitudinal direction and the lead screw moves relative to the first and second jaws transversely to the longitudinal direction; when in the fully engaged position, the first and second upper truck surfaces engaging the first and second base flange bottom surfaces respectively and the first and second jaws being fixed relative to the at least one truck.

9. The vise according to claim **1**, wherein the pillow block is selectively longitudinally adjustable to allow movement of the pillow block in the longitudinal direction.

10. A vise for holding a workpiece that reduces jaw lift, the vise comprising:

a vise base having a base length extending in a longitudinal direction and a base width transverse to the longitudinal direction, the base having a base bottom to support the vise base on an associated underlying surface, the vise base further including a longitudinally extending guide channel that includes a first inwardly extending base flange and a second inwardly extending base flange, the first inwardly extending flange having a first base flange bottom surface and the second inwardly extending base flange having a second base flange bottom surface;

at least one truck that is shaped to be received in the longitudinally extending guide channel for selective longitudinal movement in the longitudinal direction, the at least one truck having a first truck flange and a second truck flange opposite of the first truck flange, the first and second truck flanges being shaped to be received by the longitudinally extending guide channel for the selective longitudinal movement, the first truck flange having a first upper truck surface and the second truck flange having a second upper truck surface wherein the first upper truck surface faces the first base flange bottom surface and the second upper truck surface faces the second base flange bottom surface, the at least one truck further including a threaded truck lead screw opening having a truck lead screw thread, the at least one truck having a jaw mount that includes a truck lift surface;

at least one jaw that is selectively securable relative to the at least one truck, the at least one jaw including a jaw clamping surface extending in the longitudinal direction and configured to engage an associated workpiece, the at least one jaw further including a truck mount that is shaped to receive the jaw mount of the at least one truck, the truck mount having a jaw lift surface;

a lead screw that extends in the longitudinal direction and is selectively rotatable about a lead screw axis, the lead screw having a screw thread coaxial with the lead screw axis and operably connected to the truck lead screw thread wherein rotation of the lead screw in a first rotational direction moves the at least one jaw and the at least one truck toward the associated workpiece and rotation of the lead screw in a second rotational direction moves the at least one jaw and the at least one truck away from the associated workpiece;

wherein rotation of the lead screw in the first rotational direction moves the at least one jaw and the at least one truck from a non-engagement position wherein the jaw clamping surface is spaced from the associated workpiece toward an engaging position wherein the jaw clamping surface engages the associated workpiece and a fully engaged position wherein the jaw clamping surface is tightened against the associated workpiece;

when in the non-engagement position, the at least one jaw being movable relative to the at least one truck and the vise having a movement clearance between the first upper truck surface and the first base flange bottom surface allowing the longitudinal movement of the at least one truck relative to the vise base; when in the engaging position, engagement between the jaw clamping surface of the at least one jaw and the associated workpiece urging the jaw lift surface against the truck lift surface thereby urging the first upper truck surface toward the first base flange bottom surface and wherein the at least one truck moves relative to the at least one jaw transversely to the longitudinal direction; when in the fully engaged position, the first upper truck surface engaging the first base flange bottom surface and the at least one jaw being fixed relative to the at least one truck;

wherein the at least one truck includes a first truck and a second truck, the at least one jaw includes a first jaw and a second jaw; the vise further including a pillow block, the pillow block being securable relative to the vise base between the first and second trucks, the pillow block having a lead screw opening that is shaped to receive the lead screw, the lead screw opening being slotted to allow movement of the lead screw relative to pillow block that is transverse to the longitudinal direction, wherein when in the engaging position, the engagement between the jaw clamping surfaces of the first and second jaws and the associated workpiece moves the first and second trucks and the lead screw transversely to the longitudinal direction, the pillow block is selectively longitudinally adjustable to allow movement of the pillow block in the longitudinal direction; wherein the lead screw includes a lead screw groove having a first groove wall and a second groove wall, the lead screw groove being shaped to lock the lead screw relative to the pillow block longitudinally between the first and second groove walls wherein the longitudinal movement of the pillow block in the longitudinal direction moves the pillow block, the lead screw and the first and second trucks together in the longitudinal direction.

11. The vise according to claim **10**, wherein the lead screw groove is a central lead screw groove and the vise is a self-centering vise; the longitudinal movement of the pillow block in the longitudinal direction that moves the pillow block, the lead screw and the first and second trucks together in the longitudinal direction allowing calibration of a center point of the self-centering vise in the longitudinal direction.

12. The vise according to claim **11**, further includes center pins selectively securable to the vise base centered at the center point to allow for the calibration of the center point.

13. A vise for holding a workpiece that reduces jaw lift, the vise comprising:

a vise base having a base length extending in a longitudinal direction and a base width transverse to the longitudinal direction, the vise base having a base bottom to support the vise base on an associated underlying surface, the vise base further including a longitudinally extending guide channel that includes a first inwardly extending base flange and a second inwardly extending base flange, the first inwardly extending flange having a first base flange bottom surface and the second inwardly extending base flange having a second base flange bottom surface;

a first truck that is shaped to be received in the longitudinally extending guide channel for selective longitudinal movement in the longitudinal direction, the first truck having oppositely extending first truck flanges with first upper truck surfaces, the first upper truck surfaces facing the first and second base flange bottom surfaces respectively, the first truck further including a first threaded truck lead screw opening having a first truck lead screw thread, the first truck having a first jaw mount that includes a first truck lift surface;

a second truck that is shaped to be received in the longitudinally extending guide channel for selective longitudinal movement in the longitudinal direction, the second truck having oppositely extending second truck flanges with second upper truck surfaces, the second upper truck surfaces facing the first and second base flange bottom surfaces respectively, the second truck further including a second threaded truck lead screw opening having a second truck lead screw thread that is the opposite of the first lead screw thread, the second truck having a second jaw mount that includes a second truck lift surface;

a first jaw that is selectively securable relative to the first truck, the first jaw including a first jaw clamping surface extending in the longitudinal direction and configured to engage an associated workpiece, the first jaw further including a first truck mount that is shaped to receive the first jaw mount of the first truck, the first truck mount having a first jaw lift surface;

a second jaw that is selectively securable relative to the second truck, the second jaw including a second jaw clamping surface extending in the longitudinal direction and configured to engage the associated workpiece, the second jaw further including a second truck mount that is shaped to receive the second jaw mount of the second truck, the second truck mount having a second jaw lift surface;

a lead screw that extends in the longitudinal direction and is selectively rotatable about a lead screw axis, the lead screw having a screw thread coaxial with the lead screw axis and operably connected to the first and second truck lead screw threads wherein rotation of the lead screw in a first rotational direction moves the first and second trucks toward the associated workpiece and rotation of the lead screw in a second rotational direction moves the first and second trucks away from the associated workpiece;

a pillow block, the pillow block being securable relative to the vise base between the first and second trucks, the pillow block having a lead screw opening that is shaped to receive the lead screw, the lead screw opening being elongated to allow movement of the lead screw relative to pillow block that is transverse to the longitudinal direction;

wherein rotation of the lead screw in the first rotational direction moves the first and second jaws and the first and second trucks from a non-engagement position wherein the jaw clamping surfaces are spaced from the associated workpiece toward an engaging position wherein the jaw clamping surfaces engage the associated workpiece and a fully engaged position wherein the jaw clamping surfaces are tightened against the associated workpiece;

when in the non-engagement position, the first and second jaws being movable relative to the first and second trucks respectively transversely to the longitudinal direction and the vise having a movement clearance that is a gap between the first and second upper truck surfaces and the first and second base flange bottom

surfaces allowing the longitudinal movement of the first and second trucks relative to the vise base; when in the engaging position, engagement between the jaw clamping surfaces of the first and second jaws and the associated workpiece urging the first and second jaw lift surfaces against the first and second truck lift surfaces thereby urging the first and second upper truck surfaces toward the first and second base flange bottom surfaces and wherein the first and second trucks move relative to the first and second jaws respectively and transversely to the longitudinal direction and the lead screw moving transversely with the first and second trucks in the longitudinal direction relative to the pillow block; when in the fully engaged position, the first and second upper truck surfaces engaging the first and second base flange bottom surfaces respectively and the first jaw being fixed relative to first truck and the second jaw being fixed relative to second truck.

14. A vise for holding a workpiece that reduces jaw lift, the vise comprising a vise base with a guide channel extending in a longitudinal direction, the vise base having a longitudinally extending guide channel with a base surface and inwardly extending base flanges with flange surfaces facing the vise base surfaces, the vise further including opposing trucks and opposing jaws; the opposing trucks being shaped to be received in the guide channel wherein each of the opposing trucks includes truck surfaces facing the flange surfaces and having an operating clearance between the flange surfaces to allow selective longitudinal movement of the opposing trucks in the guide channel, each of the opposing trucks further including a jaw mount to allow one of the opposing vise jaws of the pair of vise jaws to be secured relative thereto and including a truck lift surface; each of the opposing jaws including a jaw clamping surface extending in the longitudinal direction and configured to engage an associated workpiece, each of the opposing jaws further including a jaw lift surface; the vise further including a lead screw extending in the longitudinal direction having lead screw threads operably connected to the opposing trucks wherein rotation in a first direction moves the opposing trucks toward the associated workpiece and rotation in a second direction that is opposite of the first direction moves the opposing trucks away from the associated workpiece; the vise further including pillow block securable relative to the vise base between the opposing trucks and having a lead screw opening that is shaped to receive the lead screw and retain the position of the lead screw relative to the longitudinal direction; the lead screw opening being elongated to allow limited movement of the lead screw relative to the pillow block transversely of the longitudinal direction; engagement between the jaw clamping surfaces and the associated workpiece urging the jaw lift surfaces into the truck lift surfaces and the engagement causing the opposing trucks and the lead screw within the lead screw opening to move transversely in the guide channel wherein the truck surfaces move toward the flange surfaces and reduces the operating clearance.

15. The vise according to claim **14**, wherein the opposing trucks each includes a lift control projection, the truck lift surface being part of the lift control projection.

16. The vise according to claim **15**, wherein each of the opposing jaws includes a truck mount to secure each jaw relative to each truck, the truck mount including a truck mount pocket having the jaw lift surface.

17. The vise according to claim **14**, wherein the pillow block is selectively longitudinally adjustable to allow movement of the pillow block in the longitudinal direction.

18. The vise according to claim **14**, wherein the lead screw includes a lead screw groove having a first groove wall and a second groove wall, the lead screw groove being shaped to lock the lead screw relative to the pillow block longitudinally between the first and second groove walls.

19. The vise according to claim **18**, wherein the first groove wall and the second groove wall define a groove spacing, the pillow block having a thickness, the groove spacing being larger than the pillow block thickness.

20. A vise for holding a workpiece that reduces jaw lift, the vise comprising a vise base with a guide channel extending in a longitudinal direction, the vise base having a longitudinally extending guide channel with a base surface and inwardly extending base flanges with flange surfaces facing the base surfaces, the vise further including opposing trucks and opposing jaws; the opposing trucks being shaped to be received in the guide channel wherein each of the opposing trucks includes truck surfaces facing the flange surfaces and having an operating clearance between the flange surfaces to allow selective longitudinal movement of the opposing trucks in the guide channel, each of the opposing trucks further including a jaw mount to allow one of the opposing vise jaws of the pair of vise jaws to be secured relative thereto and including a truck lift surface; each of the opposing jaws including a jaw clamping surface extending in the longitudinal direction and configured to engage an associated workpiece, each of the opposing jaws further including a jaw lift surface; the vise further including a lead screw extending in the longitudinal direction having lead screw threads operably connected to the opposing trucks wherein rotation in a first direction moves the opposing trucks toward the associated workpiece and rotation in a second direction that is opposite of the first direction moves the opposing trucks away from the associated workpiece; the vise further including pillow block securable relative to the vise base between the opposing trucks and having a lead screw opening that is shaped to receive the lead screw and retain the position of the lead screw relative to the longitudinal direction; engagement between the jaw clamping surfaces and the associated workpiece urging the jaw lift surfaces into the truck lift surfaces and the engagement causing the opposing trucks to move transversely in the guide channel wherein the truck surfaces move toward the flange surfaces and reduces the operating clearance;

wherein the pillow block is selectively longitudinally adjustable to allow movement of the pillow block in the longitudinal direction; the pillow block is selectively longitudinally adjustable to allow movement of the pillow block in the longitudinal direction; wherein the lead screw includes a lead screw groove having a first groove wall and a second groove wall, the lead screw groove being shaped to lock the lead screw relative to the pillow block longitudinally between the first and second groove walls wherein the longitudinal movement of the pillow block in the longitudinal direction moves the pillow block, the lead screw and the opposing trucks in the longitudinal direction.

21. The vise according to claim **20**, wherein the lead screw groove is a central lead screw groove and the vise is a self-centering vise; the longitudinal movement of the pillow block in the longitudinal direction that moves the pillow block, the lead screw and the first and second trucks together in the longitudinal direction allowing calibration of a center point of the self-centering vise in the longitudinal direction.

22. The vise according to claim 21, further includes center pins selectively securable relative to the vise base centered at the center point to allow for the calibration of the center point.

23. A vise for holding a workpiece that reduces jaw lift, the vise comprising a vise base with a guide channel extending in a longitudinal direction, the vise base having a longitudinally extending guide channel with a base surface, the vise base having a first inwardly extending base flange and a second inwardly extending base flange, the first inwardly extending base flange having a first base flange bottom surface and the second inwardly extending base flange having a second base flange bottom surface; the first inwardly extending base flange further including a first base flange top surface and the second inwardly extending base flange further including a second base flange top surface; the vise further including opposing trucks and opposing jaws; the opposing trucks being shaped to be received in the guide channel wherein each of the opposing trucks includes truck surfaces facing the first and second base flange bottom surfaces and having an operating clearance that is a gap between the truck surfaces and the first and second base flange bottom surfaces to allow selective longitudinal movement of the opposing trucks in the guide channel, each of the opposing trucks further including a jaw mount to allow one of the opposing vise jaws to be secured relative thereto respectively and including a truck lift surface; each of the opposing jaws including a jaw clamping surface extending in the longitudinal direction and configured to engage an associated workpiece, each of the opposing jaws further including a jaw lift surface; the vise further including a lead screw extending in the longitudinal direction having lead screw threads operably connected to the opposing trucks wherein rotation in a first direction moves the opposing trucks toward the associated workpiece and rotation in a second direction that is opposite of the first direction moves the opposing trucks away from the associated workpiece; the vise further including pillow block securable relative to the vise base between the opposing trucks and having a lead screw opening that is shaped to receive the lead screw; the lead screw including a lead screw groove having a first groove wall and a second groove wall, the lead screw groove being shaped to lock the lead screw relative to the pillow block longitudinally between the first and second groove walls and to retain the position of the lead screw relative to the longitudinal direction; engagement between the jaw clamping surfaces and the associated workpiece urging the jaw lift surfaces into the truck lift surfaces and the engagement causing the opposing trucks and the opposing jaws to move toward one another respectively and transversely in the guide channel wherein the truck surfaces move toward the first and second base flange bottom surfaces thereby reducing the operating clearance and moving the opposing jaws toward the first and second base flange top surfaces thereby seating the opposing jaws and the opposing trucks onto the first and second inwardly extending base flanges.

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